



Aug 1948 Vol 10 No 8

Editorial

Ele GUITAR Amps

THE calling of tenders by the Government for the construction of experimental television transmitters and receivers in Australia hit the radio headlines like a bombshell.

Only a few weeks previously, the Prime Minister had said that early movement on F.M. broadcasting would not be likely because of the unjustified diversion of facilities and manpower. Overnight it looked as though there had been big reversals of policy. Once

more John Public was mystified. He certainly wasn't smitten with an urge to dash out and pay out good money for his long overdue new radio.

The position wasn't made any better by the statements of those who are pressing the case for "television at any price." "Any price" is always too much.

Now just what did Senator Cameron say? He said in effect, the same things as were said of the experimental F.M. stations which have operated merrily for the best part of two years without causing any panic. He pointed out the need for careful tests and intimated that the first steps in this regard were to be taken by the construction of experimental apparatus.

He specifically drew attention to all the difficulties of applying television to a big, sparsely populated country such as ours. He mentioned particularly problems of finance and programmes, which as most people should realise by this time, will be most difficult for us to overcome.

Our readers will know, this magazine has attempted from the start to view the advent of F.M. and television from realistic, objective angle. We are well aware of the merits and demerits of these new techniques. But we are most anxious that they should come painlessly and profitably.

That is why we must approve the logic of the Government breaking the vicious circle of manufacturers waiting for programmes, and programmes waiting for clients. Someone adequately financed must step in sooner or later and remove the dead-lock. All we see at the moment, however cautiously we may cock an eye at some possibilities, is the first step towards the establishment of inevitable and desirable services somewhere in the future. Experimental services, when they do eventuate, will give the radio trade and set builders something to bite upon in anticipation of the future.

Any activities of ours in the experimental field, and they may not be far away, will be carried on under this clear understanding. In the meantime, relax, John P! The final television screen will not be yours for many a long day to come.

John Moyle

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1948

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THE WORLD'S SMALLEST JET ENGINE



A MODEL Vampire aircraft fitted with a "Jeter" model jet engine which weighs only $\frac{3}{4}$ ounce and is less than 1 inch in diameter. It has power enough to fly 2 ft. wingspan models, and is an English development.



The half-wave centre fed aerial rod mounted on the rear bumper bar. We are on our way!

gong, and even negotiated the height of Hassan's Walls at Lithgow, to be heard by another listening amateur in the big city. For years the performances remained unbeaten.

With other enthusiastic experimenters, some of whose names have now forgotten, we travelled roads and sent signals criss-cross over the countryside. Then the intervened, and amateur stations were closed for the duration.

When peace arrived, my interest in mobile work was revived. About two years ago, encouraged by great advances in technique made possible by wartime developments, a plan was evolved to develop equipment which, I hoped, would one day be suitable for news reporters to carry in their staff cars. Radio and Hobbies' staff grew, and as its new technical men were licensed amateurs, we developed a technique which helped me in the numerous essential tests between mobile and ground stations.

Some of the early equipment has been described in our magazine and in the Short Wave Handbook, which was produced last year. The work was necessarily a slow job, as it was a spare time venture. But, little by little, we learned the inevitable lessons needed to step-up efficiency on these higher frequencies, to provide power supplies which would operate silently from six-volt car batteries, to form estimates of distance

First Radio News Car

In last month's Radio and Hobbies, Herbert Turner told you how for the first time in England, two-way radio was used for news reporting—a "scoop" by the big Kemsley group of newspapers. This month we are able to tell you how the staff of Radio and Hobbies helped their colleagues on the Sydney Daily Sun to repeat the performance in Australia. The first radio-reported news was flashed from car to news editor on the morning of Friday, July 2. As we go to press, no other Australian newspaper has yet installed similar facilities. Soon The Sun will be operating a fleet of radio equipped cars, giving it fast news coverage over still wider fields.

READERS of the old Wireless Weekly, from which Radio and Hobbies sprang, will remember that, as far back as 1936, I was carrying out experiments in mobile communication on ultra-shortwaves.

The frequency used was about 60 megacycles. The equipment—a 35-watt modulated oscillator and super-regenerative receiver—makes me smile a little now in retrospect, but its performance was such as to make

me believe that, some day, more modern installation would create a revolution in many fields, particularly that of newspapers.

In those days, through a crackle of interference and whine of generators, signals were sent to Sydney from all the picked spots round Sydney—Bulli Pass, Mt. Victoria, Kurrajong Heights, Gosford, and Wyong. My old Morris car climbed the rough top of the Gib at Mitta-

tance coverage, aerial systems, and power requirements.

After the preliminary road tests were completed we had a fairly good idea of what was wanted. The next step was to improve the original transmitters and receivers until they reached what was considered a satisfactory standard of high efficiency.

A new start was made, and I then searched for other experimental stations as far from Sydney as possible to gain experience in communication with weak signals. By this time, all the local amateur stations were full-strength contacts, and even stations in Gosford and Newcastle were easy to hear.

After I had been successful in contacting stations in Young (200 miles) and Canberra (150 miles), the last almost every night for seven months we were reasonably sure that ground equipment was doing the job. Once again I turned to the hook gear and began to take stock.

Then, almost out of the blue, the PMG notified that it was prepared to grant a licence to Associated Newspapers, which, of course, publishes Radio and Hobbies.

The frequency we were given was 70.46 megacycles, 20 megacycles higher than the experimental band at 50 megacycles. The first step, therefore, was to change everything to the new frequency. We soon discovered that the job would entail considerable modification in order to compensate for the lowered efficiency imposed by that extra 20 megacycles.

As we had already established a good start, it occurred to me that by a week or two of intensive effort, we might be first in the field. So we divided the work to be done into sections, each member of the staff to be responsible for some of it.

FINAL EQUIPMENT

In just under two weeks we were ready. During that time, the ground transmitter had been rebuilt, its power stepped up to just over 200 watts input, and its performance checked. The car transmitter was fitted with an extra stage, until it was able to deliver the power needed with good efficiency. The fixed station receiver was duplicated to operate from a six-volt vibrator power supply which also powered the transmitter, and the entire aerial system re-erected for the change-over from 50 to 70 mc.

One of our biggest hurdles was the provision of crystals for both transmitters. These were required to hold frequency to an accuracy of .03 per cent., and would normally take some weeks to obtain from commercial sources. This was far too long.

In Australia!

A quick canvass of likely sources brought to light a number of good crystals somewhere near the frequency required. My crystal grinding outfit was brought from obscurity (you saw it recently on one of our front cover pictures) and after a couple of evenings' careful grinding, the crystals were ready. When checked by the PMG's frequency standard, their accuracy was .01 per cent., three times better than necessary!

On the Wednesday before July 2, we made our first road test. We trekked round the suburbs, using a special test permit, and tried out the gear under all conditions, good and bad. By midnight, we had worked out a few final improvements, which were incorporated the following day. On the Thursday evening, I took the car down the South Coast, to see whether I could use our ground station, installed on the roof of The Sun building. At



John Moyle sends out the first instruction to the car "somewhere in Sydney." Reporter Kath. O'Neill has just received it by phone from The Sun news editor Jack Toohey. Receiver and transmitter are in the background.

Bulli Pass, except for a few spots badly shielded, communication was still 100 per cent. I gave up the job!

switched from its assignment to a more important job.

Several news stories appeared in successive editions of the paper as they came in and were phoned through to the news room. Home-going Sydney read them in the evening Sun. A dream had come true.

Although the equipment used is not physically in its final form, a few details about it might be interesting.

VALVE TYPES

One of the difficulties to be faced was the lack of the latest valves designed for these high frequencies. They were virtually unobtainable at short notice. For the ground transmitter, therefore, a four stage exciter was built, multiplying frequency 16 times. The last valve was an 815, the only really modern valve in the whole equipment. It proved easily capable of driving the final stage of two 834 valves, a VHF type of reasonable efficiency despite its ten-year-old design. These valves delivered about 110 watts into the aerial system, comprising two half-waves in phase strung vertically.

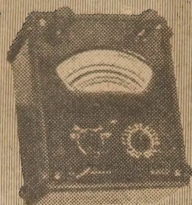
The modulator was a class-B type using 830-B valves, and driven by a three-stage sub-modulator. The sub-modulator has been described in Radio and Hobbies, and the transmitter final amplifier, in slightly simplified form, is detailed in this issue.

We crawled into bed that night, exhausted, but satisfied.

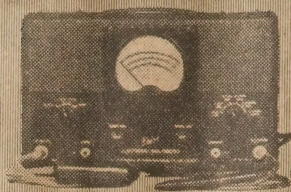
On Friday morning, we got out the car, changed the batteries, loaded on board a reporter and photographer, and commenced our first day's reporting, having received our final licence clearance from the PMG and the call sign VH-2AN.

Although it so happened that our first two jobs, given to us by house telephone from The Sun news editor, were in rather badly shielded spots, the reporters at the car and here at The Sun building received their instructions and their "copy" word perfect. Twice the car was

by John Moyle



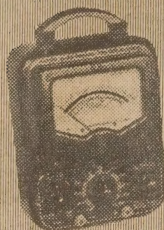
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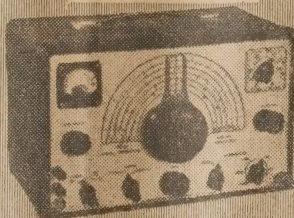
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Signal Generator
150 Kc. to 30 Mc.



A



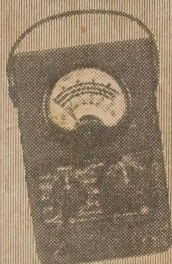
B



C



D



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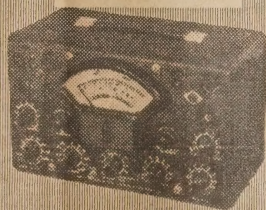


Modulated Oscillator
150 Kc. to 30 Mc.

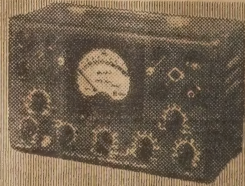


E

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B Model RN475—5 inch E Model 625—6 inch
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The receiver was a ten-valve superheterodyne fitted with a most effective noise-limiter, which, despite the fact that AM was used throughout, is capable of reducing electrical interference to a very low value.

The mobile transmitter used four stages, and, although it has since been modified, used an 807 output valve, the others being 6V6G types. The transmitter multiplies frequency 12 times. The receiver was of the fixed-tune type, since it was required to receive only one station. It has since been converted so that the oscillator is crystal controlled in the same way as the transmitter, to guard against vibration detuning the signal. The aerial was a vertical half-wave rod mounted on the rear bumper bar. Although other types possess certain advantages, and may eventually supplant this type of aerial, the half-wave is an excellent all-round performer.

MOBILE POWER

Power for the mobile equipment is obtained from heavy-duty vibrator supplies operated from six volts dc.

Both fixed and mobile stations are controlled by a single switch, one position to transmit, and one to receive. For the car, this switch is incorporated on the microphone it-

Neville Williams lets a citizen tell his own story, while reporter Dave [unclear] takes a shorthand note for future reference.

self, so that actual operation is reduced to extreme simplicity.

The final equipment such as will be fitted to a number of other cars will be built in unit form, and installed in rear compartment of each car. Its actual operation will then be carried out by a system of relays, similar to that fitted to the first model.

THE MODERN NEWS REPORTER



It is certain that progressive modifications and improvements will eventually step up performance of our old faithful, as is always the case. But in my own mind, and those of my loyal helpers—Neville Williams, who steered the mobile transmitter through its final

stages; Ray Howe, who built the car receiver, and Maurie Finlay, whose special care was the aerial system, it will always hold a special place.

For, as The Sun described it in the issue of July 2, it has, in its own way, made newspaper history.

NEWS PICTURES SENT BY RADIO IN ENGLAND

FROM England, H. G. Turner reports that the Kemsley newspapers have been operating a reporter radio-telephone network for several months. They use a main transmission set in a van, and reporters can carry walkie-talkie sets operating away from the van. Picture transmissions of the Derby were made from this van, parked outside the main stands, and 17½ miles from the receiving station on Kemsley House, London.

Transmissions were made by a Muirhead-Belin portable machine which the group uses to send pictures on long-distance telephone lines. It is capable of sending a picture 5½ inches by 8in. in approximately 11 minutes.

It was found possible to mate the transmitter and the wire-photo equipment without alteration to either other than the addition of a switch to the transmitter so it

could be used both for speech and pictures.

With the picture transmission apparatus it is possible to begin sending and then stop temporarily while a reporter sends an urgent voice message without affecting the quality of the picture.

This development means that now, news photographs and reports can be received in an office within minutes of reporters and photographers arriving at a spot.

It means Test pictures could be in Australia 30 minutes after being taken at Lord's.

It means an end to the previous delay with wire-photo equipment caused by finding a long-distance telephone office and plugging in the portable equipment. Because of the superior quality of picture transmission and greater reliability, wire-photo will still be used in prefer-

ence to radio-photo where conditions are equal.

Britain's national newspapers have capitalised further on the Government's recent release of radio frequencies for reporters' radio-telephones by using the frequencies to transmit radio pictures.

Both the London Evening Standard and the Kemsley group of newspapers carried radio pictures of the Derby sent from the course only a few minutes after the horse passed the post.

The successful experiment was carried out by linking portable wire-photo transmitters to the semi-portable transmitters previously used for reporters' radio-telephones.

Results were fair. Pictures were equal to a radio-picture from Britain received in Australia under favorable but not perfect transmission conditions.



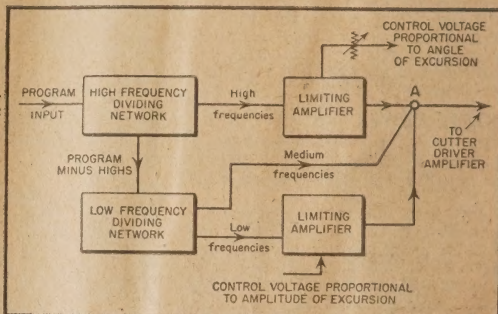
Technical Review

ENGINEERS WAGE WAR ON RECORD NOISE

Engineers are going to unusual lengths to achieve the utmost realism in disc recording and playback. Three distinctive approaches to the problem are featured in recent issues of overseas technical journals.

THE British ffr system is already well known to readers involving, as it does, an extension of the frequency range to at least 13,000 c/s and the use of a surface material having an improved noise and distortion characteristic. This and parallel developments make possible a considerable improvement in ultimate quality, but surface noise re-

A block diagram of the Q-C recording system, which allows a high average recording level but avoids overcutting and steep wave fronts. Frequency characteristic on opposite page.

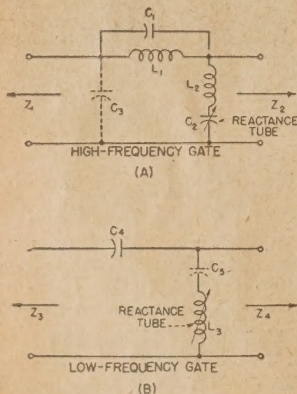


How It Works

Signal-controlled reactance tubes in these basic filter circuits act as gates that move the ends of the audio response curve inward and outward continuously and independently to let only the desired audio modulation through.

All noise signals in portions of the spectrum not having audible music components at a particular instant are suppressed.

Fundamentals of desired high-frequency notes are filtered out and rectified by a control circuit to change bias and hence capacitance of C_3 in high-frequency gate and harmonics of desired low-frequency notes similarly vary inductance of L_3 .



to vary the cut-off frequency of the high and low pass "gates."

In the normal way there is not sufficient energy in random noise voltages to operate the system so that the gates adjust themselves more or less automatically to pass only the musical frequencies which are at a significant level. In practice, therefore, the response range of the amplifier is varying continually at either end, passing the musical frequencies but suppressing random noise outside the range.

OCTAVE FILTERS

A rather similar result is obtained by inserting filters in the amplifier system so that the programme material is handled by a series of channels, each approximately one octave wide. The individual channels operate only when "opened" by a component of the music which hap-

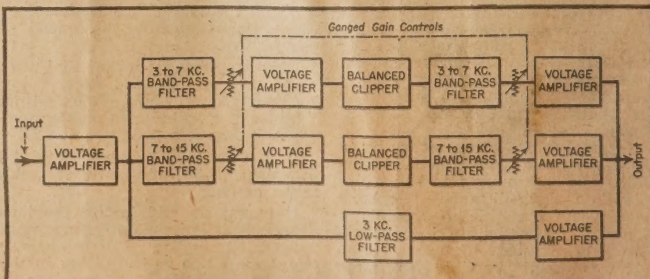
pens a stumbling block to complete enjoyment of the recorded material.

Although some records are better than others in this respect, the fact remains that many imperfect or partly-worn discs may require to be played and some form of noise suppression is desirable at the playback end.

One of the most interesting devices for this purpose is the dynamic noise suppressor developed by H. H. Scott. In this device the frequency response of the amplifier system is limited at either end by tuned circuits whose cutoff is controlled in turn by reactance tubes.

The programme material is passed through selective channels which respond to the degree of energy in particular portions of the spectrum and produce a controlling bias accordingly. This bias operates upon the reactance tubes and causes them

Illustrating the operation of the Scott "dynamic noise suppressor."



This block schematic shows the essentials of the anti-noise playback system suggested by S. L. Price. A balanced amplifier allows the use of channels just under 1.5 octaves wide. The high frequency channel opens only when the programme contains tones higher than 7000 c/s.

pens to lie within the particular octave.

Furthermore, their operation is deliberately made non-linear, by the use of suitable biased amplifiers or rectifiers, so that they do not respond to voltages of very low amplitude. This tends to suppress background noise.

Non-linearity of this nature, of course, produces severe second harmonic distortion and the filters must therefore be made highly selective in their action, and the channels sufficiently narrow so that they will pass the contents of a near-octave without any of the harmonics.

Suitable filters are both expensive and critical in adjustment and domestic versions of this type of noise suppressor employ a simplified system which does not achieve all the results given by one having a complete set of octave filters.

BALANCED AMPLIFIER

In the March, 1948, issue of "Audio Engineering," S. Leslie Price describes a system in which the noise suppression is achieved by a non-linear balanced push-pull circuit, which in itself, tends to eliminate the second harmonic. It is therefore necessary to discriminate only against the third and higher order harmonics. This means, in practice, that each channel can be slightly less than 1.5 octaves wide and that fewer channels are required to cover the complete spectrum.

It is further simplified by arranging for the amplifier to pass the middle and lower frequencies without modification. The frequencies above 3000 c/s being required to traverse noise suppression channels. The main channel handles from 3000 to 7000 c/s and requires full filtering, but the 7000 to 51,000kc. channel can be simpler by virtue of the fact that the third harmonic of 7000 c/s normally falls outside the range of hearing.

At the moment, noise suppression systems of this type are confined in their interest mainly to broadcast stations, although in the US they are finding their way into some of the more expensive systems for private or semi-private use. They are necessarily involved and expensive and the average home listener will still be obliged to tolerate the noise in discs which do not achieve the higher standard of excellence.

LIQUID LENS MAGNIFIES IMAGE



TELEVISION pictures received on seven- or ten-inch television picture tubes can be enlarged to the approximate size of those produced on a 15-inch picture tube, through the use of a magnifier developed by the Tube Department of The Radio Corporation of America.

When in use, the magnifier is set up about seven inches in front of the television picture screen, using two metal supports supplied with it. When made necessary by an elevated position of the television receiver, the lens may be suspended from the

ceiling and securely anchored there by tie-wires.

One of the newest applications of plastics in the optical field, the picture magnifier is a transparent Plexiglas lens filled with a clear oil having the same optical properties as the plastic material, a combination that produces a true optical lens.

Designed for use with all make of direct-view home television receivers, the new lens has proved its effectiveness in taverns, clubs, and other locations where larger television pictures are desired.

RECORDING METHOD

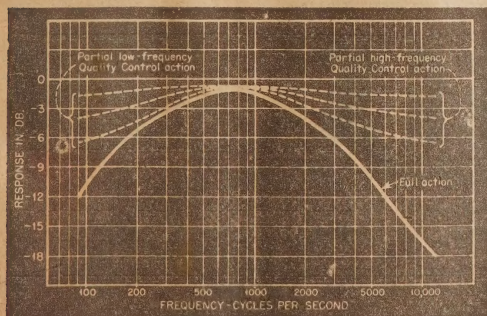
On the recording side, Emery Cook describes what he terms a "QC Computer" which is intended to prevent over-cutting and excessively sharp

angles of the track, while maintaining a high average recording level.

Examining the situation, he points out that overcutting occurs chiefly at low frequencies, where the amplitude is high in relation to energy value. Abrupt groove angles on the other hand, occur chiefly at the very high frequencies, becoming more serious when the cutter is operating towards the centre of the disc.

His solution to the problem involves dividing the programme material into high, low and medium frequency channels. The medium frequencies which have the greatest effect on the human ear, are passed through the system unaltered. However, the low frequency components pass through a simple limiting amplifier which comes into operation as the amplitude approaches troublesome proportions and provides a safeguard against over-cutting.

(Continued on Page 11)



The effect on frequency response of the Q-C recording system. Audible effect is claimed to be almost nil, since the limiting action is instantaneous and the full frequency range is available for all programme material at average level.



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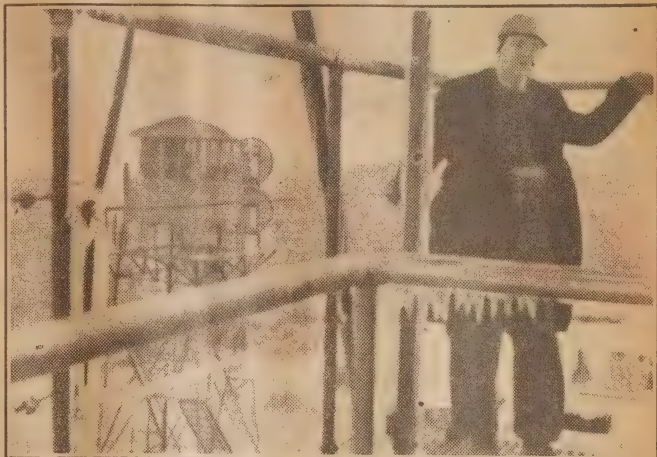
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MICRO-WAVE RELAYS SURMOUNT WINTER STORMS

Experience during the past winter months in the US has proved the reliability of micro-wave radio relays. When heavy snow and winds put wire lines out of action, Western Union carried on with an RCA broadband radio relay system.

THE system had been in experimental use between the two cities since the spring of 1945. Although ice and snow covered all parts of the relay towers and the dish-shaped antennas, the system functioned perfectly, handling all Western Union traffic from New York to points south.

At the beginning of the emergency, the radio relay link was used for 41 carrier telegraph channels. A few days later 32 more telegraph channels were added. Eventually a bandwidth equivalent to 100 channels was called into action. This load represented many more than 100 telegraph printer channels, since some of the circuits were multiplex circuits over which several operators



When the blizzard subsided, engineers found that the whole structure was still coated heavily with ice. On the left is one of the parabolic antennas, completely filled with snow. Communications were not interrupted, even by this.

proved advantage of being invulnerable to ice storms and is not affected by wind and electrical storms as is the case with conventional pole line systems.

RCA engineers developed an entirely new double frequency-modulation system for this type of multi-channel operation which results in superior quality of transmission over a chain of many stations.

of supplying facilities for 1152 separate telegraphic printer channels operating in each direction, has the

ENGINEERS WAGE WAR ON NOISE

(Continued from Page 8)

The high frequency channel also involves a limiter, but its operation is governed, not by absolute amplitude but by cutter velocity, which determines the steepness of the wave front.

At moderate recording levels neither limiter operates to any extent, so that the overall frequency response is substantially level. However, when an excessively loud signal affects the amplifier, or when the nature of transient sounds is such that an abrupt wave front is produced, one or both limiting amplifiers come instantaneously into operation.

This limitation of treble and bass peaks means, of course, that the frequency response of the system departs from its normal level characteristic and shows a loss at both ends of the spectrum. The writer claims, however, that this limitation of frequency response has a purely instantaneous effect and is no more apparent to the ear than is the period of darkness to the eye between frames on a motion picture screen.

Photomicrographs of QC controlled

curves certainly bear out the writer's claim for the operation of the system. He makes the point that play-back discs with some tendency to over-cutting and steep wave fronts sound impressive under ideal conditions, at least on the outer sections of the disc. However, they are subject to excessive wear and processed duplicates are likely to give mediocre results.

DIAMONDS are more useful as detectors of certain types of atomic radiation than the standard Geiger-Muller counter, the National Bureau of Standards revealed last month.

To use a diamond as a counter, it is clamped between two small brass electrodes maintained at a difference in potential of about 1000 volts. When a source of gamma radiation is brought within range of the diamond pulses of current occur across the electrodes, which after amplification may be detected and counted on any suitable indicating device, such as an oscilloscope, a current meter, a set of headphones, or a loudspeaker.



sent and received telegrams simultaneously.

The Western Union radio beam system between New York and Philadelphia is a segment of a triangular network of multi-channel communications now under preparation between New York, Washington, DC, and Pittsburgh.

In this system now under construction, ordinary telegraph poles and wires will be replaced by a chain of radio relay stations spaced about 30 miles apart.

In relay operation each station receives the transmission from the preceding station of the chain and relays it to the next station. Radio relay service of this type in the present system, operating in the 3900 to 4200 megacycle band, is capable

THERE ARE MANY REASONS WHY MAN



One of Australia's greatest assets is her wool production. The average man is not aware of the highly scientific nature of wool growing, or the real reasons why natural wool is almost impossible to imitate. This article tells of the fundamental facts which make your woollen clothes durable and warm.

The British Museum has specimens of magnificent cloth woven by the Egyptians and Persians in the fourth century of the Christian era.

According to some ancient writers, notably Herodotus, the Babylonians were expert in the making of woollen yarns. Plato also refers to the crossing of woollen threads to produce woven fabric.

They apparently understood the whole art of the treatment of wool, for in the ruins of Pompeii was found a complete scouring plant.

The Gauls, according to Pliny, produced a fabric from wool without weaving or spinning. This fabric was obviously a "felt." It seems probable that felt was the first fabric to be used as a clothing material after the use of skins, for it is very simple to make, as witness the process used by the Mongols.

It is recorded that when Britain was occupied by the Romans, a woollen factory was established at Winchester. It was the Romans who taught the Britons the finer points of weaving and spinning, something of which the Britons already knew in a crude fashion.

ITS PROPERTIES

Wool is a substance possessing some outstanding properties which make it excellent for clothing purposes. The properties of wool have not been duplicated either by other natural fibres or artificially.

Many attempts have been made to

Attractively woven jumpers are only one example of the wide use for woollen goods. Some wool fabrics are exceedingly fine, and all have a warmth unobtainable from any substitutes.

produce a synthetic article which would be comparable with wool, but without success. The attempts in this direction have been directed mainly to the production of a substance which has the advantages of wool without its disadvantages. The advantages of wool are that it is warm, it is soft, does not crease, wears well, and it "felts."

The disadvantages are that it shrinks and sometimes causes skin irritation or tickling.

Wool is of peculiar mechanical structure and is quite different in this respect from any other material.

The fibres are cylindrical in shape, and made up of a number of minute cells. It has three principal parts: (1) the outer scaly covering, (2) the inner bark, and (3) the central portion called the "medullary" portion.

If a fibre of wool is stroked between the finger and thumb in each direction it will be found that the

layer of loose wool. The mat is then rolled up around a wooden pole so that the pole protrudes from both ends. These ends are fastened to traces and hitched to a horse, which drags the roll along the ground for some miles.

This dragging process causes the wool to entangle and form a warm, rainproof cloth, with which the Mongol makes a new tent or sleeping mat.

EARLY HISTORY

When wool was first used in the manufacture of woven cloth is not clear, but it is certain that the practice dates back to very early times.

THE use of wool for the making of clothing has been known from the earliest times of man's existence.

Probably the earliest materials to be made from wool was felt cloth. History shows that such cloth was made in very primitive ways by people who had no contact with civilisation.

The ancient Mongols soon found that the rubbing together of wool fibres caused them to entangle and form a fairly solid mass.

The process employed by the Mongols in making felt cloth is simplicity itself.

An old piece of felt cloth is laid on the ground and covered with a

CANNOT MAKE WOOL ARTIFICIALLY

by **Calvin Walters**

fibre feels rougher in one direction than the other. It is rougher when stroked from tip to root.

This roughness is due to the outer layer of the fibre, which consists of a series of horny scales or thin plates, somewhat funnel-shaped and overlapping each other.

These scales have an important bearing on the quality of wool and are the main cause of its "felting," of which we will speak later.

The strength, firmness and lustre of wool depends on the structure of the scales. The dimensions, compactness and uniformity play an important part.

The elasticity of wool is well known and depends mainly on the density of the internal spindle-shaped cells.

It is interesting to know the scientific reason for the various qualities of wool and we will begin by a discussion of "why wool is warm."

A fibre of wool is crimped. This is a well-known characteristic and one which has an important bearing on the warmth of wool. The crimp or wave in a piece of wool is best seen in the wool on a sheep's back or wool which has been newly shorn.

SPINNING PROCESS

Now the spinning process of any fibre consists in arranging the fibres in a parallel fashion and twisting them together. This operation traps the air between them. When a fibre-like wool is crimped or wavy, the amount of air trapped between the fibres becomes very great indeed. In this way the air between the fibres becomes a good insulator against cold, and the fabric is said to be warm.

In the wool industry the tightest yarn contains by volume 40 per cent of wool and 60 per cent of air. When the yarn is woven into fabric it contains still more air.

It has been proved that, owing to the elastic nature of wool, it maintains its open structure even after a considerable amount of wear and deformation. This is peculiar to wool. No other fabric has this property.

According to Rachel Makinson, of the Council for Scientific and Industrial Research, wool does actually provide protection from sudden chills. The reason given for this is that wool is able to absorb large amounts of moisture in a reaction which produces internal heat in the wool with the absorption of water.

HUMIDITY

If a man is indoors wearing a woollen suit when the temperature is 18 degrees and the humidity is 45 per cent, the suit will absorb moisture. At the end of the couple of hours it will have reached equilibrium with the atmosphere, and his suit will contain a weight of water equal to 10

per cent of the dry weight of the wool.

If he now goes outside into a temperature of 5 degrees centigrade and a humidity of 95 per cent, his suit begins to absorb more water, until after a couple of hours his suit will contain 27 per cent of its dry weight of water.

But during this water absorption process, heat is evolved in the suit, and it has been proved that an average worsted suit will, under the conditions assumed above, evolve as much heat as the human body normally loses in half an hour.

Our next question is: "Why does wool shrink?"

Now, most types of fabric shrink, but most of them also cease to shrink after a certain minimum is reached. Not so with wool. This continues to shrink with every wash.

If a woollen fabric is examined after every wash, it will be found that the threads of yarn which constitute the fabric gradually lose the outline. The ladies say that the threads "thicken up."

What actually takes place is that the individual fibres in the yarn migrate from one thread of yarn to another, and the spaces between the threads gradually fill up more and more.

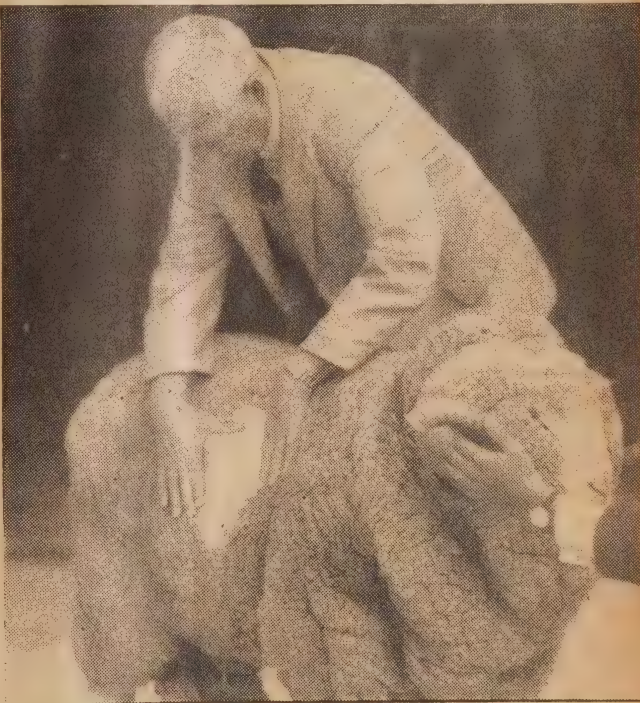
The present theory of this migration also explains the mechanism of shrinking, and is as follows:—

It has been found that each wool fibre migrates towards its own centre.

Any particular fibre in the thread of yarn is held in position by friction between itself and its next-door neighbors. This friction is aided by the scales on the fibre. When, however, outside forces, such as moisture, heat, and agitation cause movement of the fibre, they curl up and become entangled with each other.

The fibres in their migration process drag these entangled clumps closer and closer together, and the fabric has shrunk.

Having now discussed the shrink-



Wool classing is almost a fine art, for upon the various factors discussed in this article depend the suitability of the clip for various purposes. Col. Somerville, of the Sydney RAS, here examines the fleece of a prize ram.

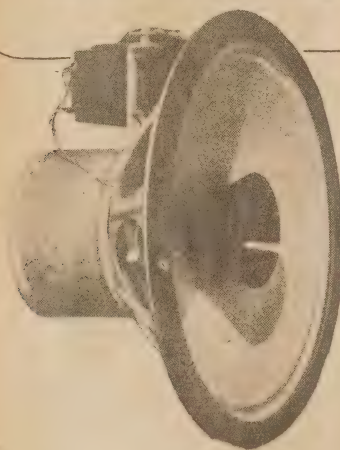
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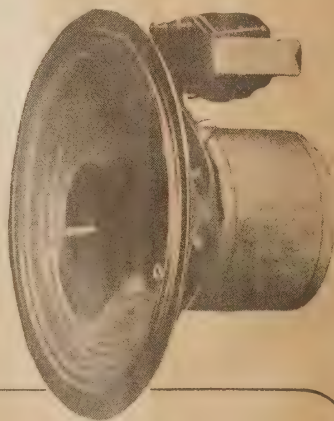
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age of wool, we will examine the question of elasticity.

Elasticity of wool is the power it possesses of assuming its normal condition after pressure or other stresses have been removed.

If a quantity of cotton is compressed, it will remain comparatively solid after the pressure is removed. A quantity of wool, on the other hand, will rebound to its normal bulk.

The more crimped or wavy the wool, such as the merino variety, the greater the elasticity.

Wool has some peculiar properties of elasticity. For instance, the completely dry fibre is completely elastic and returns rapidly to its original condition on the removal of stress. Such a dry fibre will break after being extended by about 20 per cent of its length.

When, however, wool fibres are subjected to moisture, several features become manifest. If the fibre is immersed in cold water, it can be stretched about 50 per cent before breaking. After immersion in boiling water or steam, the fibre can be stretched about 100 per cent.

When a fibre is deformed or stretched in cold water it is completely elastic while the water is present, but this elasticity is delayed the longer the fibre is held under stress or deformation.

HARD TO CREASE

This fact explains why wool does not crease readily and keeps good shape under wear.

If wool is stretched under cold water and dried while in the stretched condition it will not recover completely to its original condition so long as it is kept dry.

Again, if the fibre is stretched in hot water, and then placed in cold water so that the stress is released, it will remain stretched. Place it again in hot water without stretching and it will return to its original condition.

Stretch wool fibre for a few minutes in boiling water and it will return, but stretch it under these conditions for some hours and it will remain stretched permanently. Not even boiling water will restore it.

All these peculiar properties, known as "setting," explain why a lady can pleat her skirt. Pleating is carried out by deforming the material under steam and then drying immediately while creased. Only hot water or steam will remove the pleats.

The felting property of wool is a result of the scaliness of the fibres and the migrating effects under the influence of agitation, heat and moisture.

INTERLOCKING

It is noteworthy that so great are the interlocking abilities of wool fibres that they can hold more than themselves. The effect of this is that as much as 80 per cent of some fibres can be mixed with wool. This property makes it possible to make felt of varying degrees of compactness and strength and insulating properties against heat and cold and sound.

SCIENCE NOTES—Prof. A. M. LOW

Some thoughts and ideas from one of England's most popular writers on everyday science.

I have mentioned before that things are not always what they seem, and now another terror has been added to life by the discovery of an eminent scientist that the impression of speed can be given by drugging certain localised parts of the anatomy. I rather like the idea of selling a bottle with every slow car, or it might be doled out to householders who are waiting for their homes to be rebuilt. It might also be used to study all the wasted motion used in laying bricks. But I doubt if they give enough attention to the fact that human beings can only put out a certain amount of effort by custom.

Motor car drivers do not want infinitely variable gears, because they cannot be bothered to use them or to learn the right speed at which an internal combustion engine gives its best compromise between comfort and efficiency. Bicycles have often been designed with handlebars connected to chains so that speed could be increased. It is forgotten that when pressing upon the pedal one can pull on the handlebar, and thus use the energy from the unfortunate rider to its full.

The other evening I was dining in a restaurant and was told by a friend that some people can tell the difference between Empire wines and others (if they can get them). There seems to be some difference, for poisons of many kinds vary in the rapidity of their effect upon the stomach. I should not have mentioned this word, but I commonly think of the place where what I understand an "abominable belt" is worn. Now, poisons are interesting, because some of them seem to paralyse different parts of the body, and vary in the manner in which they preserve the body or respond to chemical reaction in the hands of the police.

ARE YOU RIGHT?

So many things seem to me obvious and yet so much is a matter of opinion that I ought to be used by now to being wrong. Upon the few occasions in my life when I have been absolutely accurate knowing well that black was black and so on, it has given me enormous satisfaction. Once upon a time I went to see a stereoscopic cinematograph, and I was shown a report by a scientist of such international fame that I almost took off my hat before reading his words of wisdom.

When I read the first six lines, I went back to the beginning and read them again. They stated that by taking a right and left picture of an object it was only necessary to show these alternately upon the screen when true stereoscopy would be obtained.

Being a cautious Scotsman I reserved judgment, but the conviction soon grew upon me that I was actually right. It is obviously true that

real stereoscopy can only be obtained if the audience wears glasses and the method of showing alternative pictures only functions if right picture is not allowed to be seen by the left as well as by right eye.

Hence the colored glasses which when used to look at pictures alternately dyed red and green on film gave a stereoscopic effect which was positively astounding. Hanged old men ducked their heads, someone on the screen squirted siphon of soda-water at the audience. There are now many methods for obtaining "shadow" stereoscopy by screens with curved surfaces, by the use of prismatic viewers, but none of them really achieves its object and glasses are still despised by every member of a well-conducted audience. It is, in short, like printing of color pictures at high speed, a very tricky problem.

LONG-HANDLED DRIVERS

To make it more impressive I may recount the other occasion when I was right. At least I think so! annoyingly cocksure friend once complained at a lecture that the long-handled screwdriver was a farce. I pointed out that it was width of handle that mattered in gaining necessary leverage. Try it for yourself. My theory is that with a very long screwdriver the blade can be tilted without jumping out of slot, thus allowing the departure from vertical at the top of the handle to be appreciable. The screw is then pulled round, just as if one sticks the blade of a penknife into a screw slot to pull it round.

One can hardly deal with stings in summer-time without thinking wasps. These creatures appear to have stings like the blade of a letter. When you have been stung you knock the wasp away with howl of rage and the beast flies seemingly none the worse for it.

In the interests of science should be prepared to suffer, make the same experiment with a bee. The bee, like the dog in a poem, is the one that dies. The bee walks round and round your hand, screwing out its sting which appears to be in the form of a corkscrew.

Thought and Energy

It is extraordinary how the small amount of technical learning available to anyone seems to become more linked up in its various branches every day. We now know that the class of traffic passing over a bridge varies the amount of work that takes place. It has even been found that certain shapes of girder may produce windage in such a fashion as to cause these parts to tremble sympathetically until the tiny particles in the metal re-arrange themselves into a less strong physical formation.

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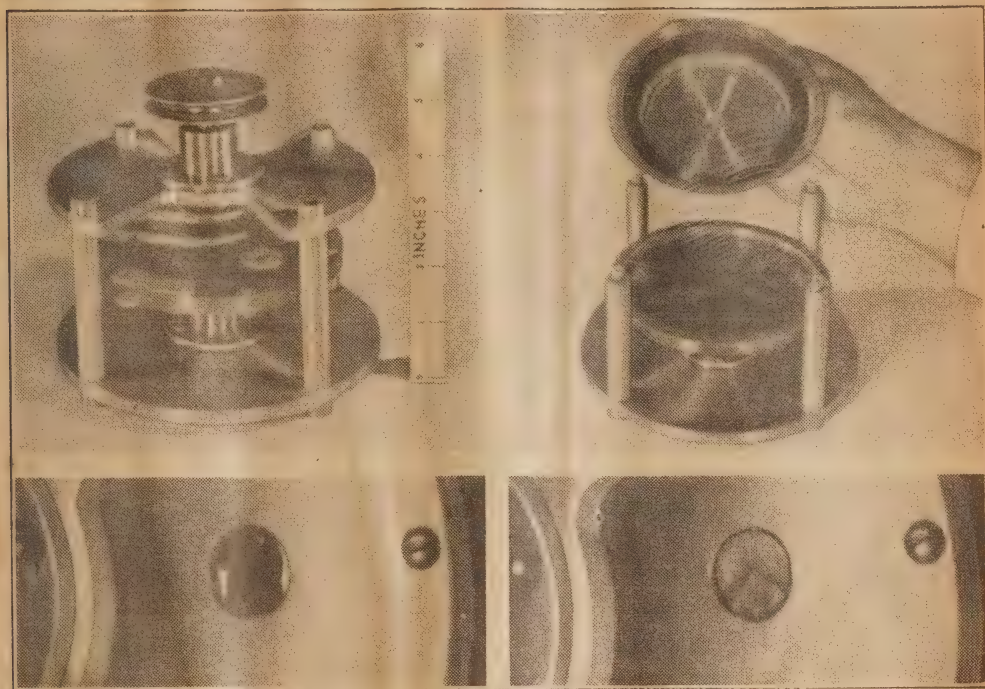
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A NEW ELECTROMAGNETIC CLUTCH



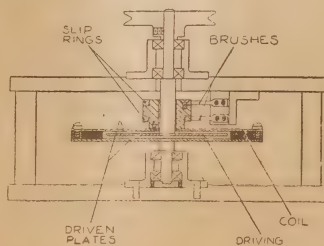
The first laboratory model of the new NBS magnetic fluid clutch (upper left) demonstrated successfully the principle that a magnetised fluid medium may be used to transmit torque from one movable plate to another, and that any degree of slippage between plates may be obtained by varying the magnetic flux in the fluid. The central chamber of the clutch (upper right), which is a very simple arrangement of driving and driven members (note the driving disc surrounded by magnet coil in upper plate), is filled with the mixture of iron power and oil when in use. Close-ups of the filling hole in the central chamber show the appearance of the demagnetised fluid (lower left) and the arrangement of iron particles when magnetised (lower right).

A new type of electromagnetic clutch having extensive applications and many unique features has been developed at the National Bureau of Standards by Jacob Rabinow, Chief of the ordnance mechanics laboratory. The development of this clutch is based on Rabinow's discovery that frictional forces between solid surfaces and certain types of fluid media can be controlled by application of magnetic fields.

CHARACTERISED by ease of control, high efficiency, smooth operation, long life, and simplicity of construction, the new magnetic fluid clutch is particularly suitable to applications in servo mechanisms, automatic machinery, automotive service, and many other fields where ease of control and constancy of characteristics are important.

The magnetic fluid clutch operates on the following basic principle: When the space between two parallel magnetic surfaces is filled with finely divided magnetic particles and a magnetic field is established between the two plates, the magnetic particles bind the plates together against movement parallel to their surfaces. The magnetic particles may be finely

divided iron which, for most applications, is mixed with a liquid, such as oil, to prevent packing and to afford smoother operation of the clutch.

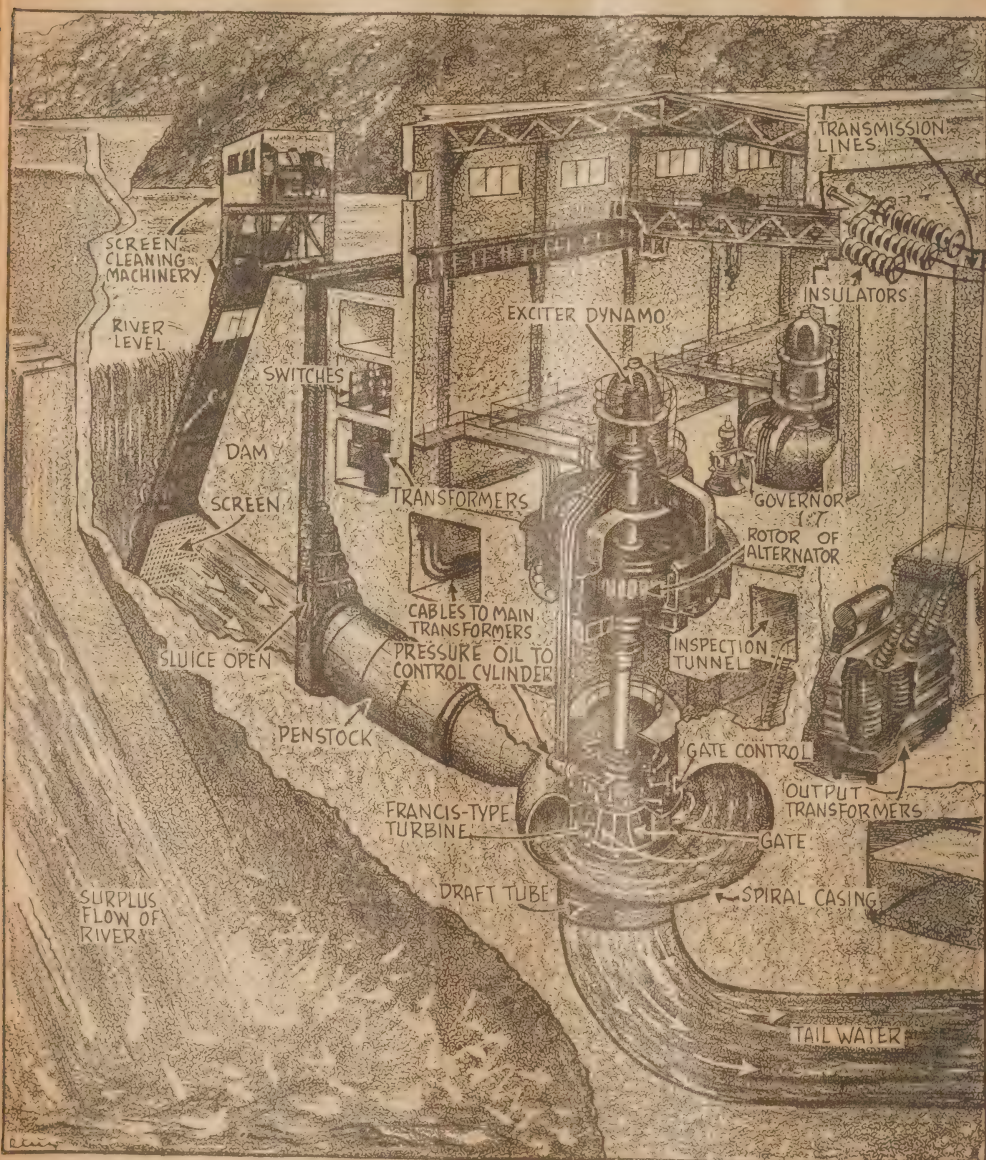


When a portion of this mixture is acted on by a magnetic field, the iron particles are mutually attracted, bind together in the field, and the mixture seemingly "solidifies"—an effect readily demonstrated by lowering a small permanent magnet into a beaker of the iron-oil mixture. As the magnetic field can be produced by an electric current, a very simple means is thus obtained for the control of the binding force over a very wide range.

Preliminary results at the Bureau
(Continued on Page 89)

Current supplied to the slip rings of the NBS magnetic clutch energises a coil in the disc-shaped central chamber, establishing a magnetic flux between the outer plates. This flux, acting in turn on the fluid in the enclosed space, produces a virtually solid mass. Any degree of slippage, or complete locking, between driving and driven members may be obtained by controlling the flux applied to the magnetic fluid.

A LOW HEAD TURBINE WATER POWER



ELECTRIC power is developed from falling water by different types of turbines, according to the form in which the water power is available.

The power of falling water now tapped on a large scale in many countries is of two kinds

—low head and high head. The former employs a large quantity of water with a low fall, the latter a small quantity at high pressure. The output from 43,000 cubic feet per minute with a fall of 47 feet is the same as that from 2300 cubic feet with a fall of 850 feet. The general principle

of hydro-electric generation is that falling water is directed through some form of water wheel or water turbine, thus causing it to rotate. Directly connected to this water turbine is an electric generator, which, by its rotation, generates electrical energy to be fed over an electrical transmission system to the various load points of consumers.

High-head water power is most efficiently tapped by the Pelton wheel, which uses a small jet of water at high speed.

Sketched here is a hydro-electric installation used on a low-head system—the reaction-type Francis turbine.

Water from the head race drops through the screen and penstock to enter the turbine casing, where it rushes round the spiral casing. There is a wheel or runner provided with vanes, into which the water passes.

WATER PRESSURE

This water is directed on to the runner by a series of guide vanes fitted on the stationary element of the turbine.

On leaving these guide vanes, the water is under pressure, so that energy is transmitted to the runner partly in the kinetic form and partly in the pressure form.

The movable guide vanes are regulated by the governor, which maintains an even speed of rotation of the turbine, the vanes being opened or closed as necessary.

The water pressure gradually decreases as the water passes through the runner on its way to the discharge pipe.

The vertical shaft attached to the turbine passes upward through a thrust block, which takes its weight, and drives an electric alternator above.

The current is fed to transformers which step up its voltage for transmission.

G.C.A. Progress

THE radar system known as Ground Controlled Approach, will soon be available to help pilots make safe landings in fog and bad weather at Liverpool (Speke) Airport.

This will be the third airport in Britain at which the Ministry of Civil Aviation has installed GCA. The system has been in use at London Airport since July, 1947, and at Prestwick since January 1 of this year.

A pilot approaching the airport in bad visibility will be able to ask to be landed by GCA, and the Aerodrome Controller in the tower will hand him over to the GCA controller, who sits in a caravan on the edge of the runway. The latter sees the plane's position on a radar screen and gives the pilot verbal instructions over the radiotelephone guiding him down to the runway. The main feature of GCA is that the aeroplane need not be equipped with any special apparatus other than a wireless receiver.

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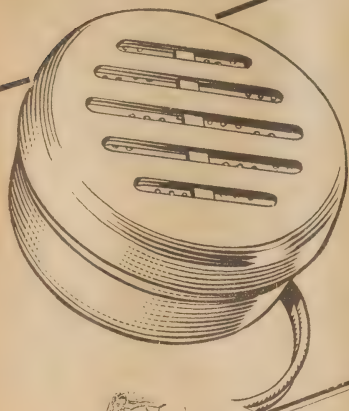


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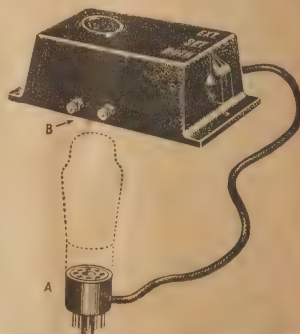
Retail Price --- 58/6

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SPEAKER ADAPTOR**

with three-position switch, for operating Set and Extension, or both. **EASY TO CONNECT.** . . . Remove output valve from receiver, plug in to the valve socket the adaptor "A" on the unit, and replace the valve in the top of the adaptor. Connect the leads from the extension speaker to the terminals "B" and the unit is ready for operation.

Retail Price --- 22/6



★ **And The "WALKIE TALKIE" PERSONAL PORTABLE**
Comprising carrying case, shoulder strap aerial, I.F.'s, valves, sockets, battery clips, knobs, off/on switch, 3in. speaker, and Ferrotune Unit.

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Head Office: 490 ELIZABETH ST.
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NEWS AND VIEWS OF THE MONTH

Television From The Air

ONE of television's greatest drawbacks—one common to all kinds of communication on the very high frequencies—is the more or less optimal range of transmitters. Location and geographical conditions often allow reception over long distances, but generally speaking, range is restricted to little better than line of sight. Particularly as television signals should be strongly received to make the best of the service.

In America, engineers are experimenting with the idea of housing transmitters in aircraft, which because of their ability to fly at great heights, will command a considerable visual range.

Recently, such an aircraft rebroadcast a television programme from a ground station so that it was clearly received at a distance of 110 miles, and maintained the service for an hour and ten minutes.

The general idea of the aerial broadcast is quite sound, but there appear to be many practical difficulties. It is a costly business to keep an aircraft aloft for long periods, and experiences with heavier-than-air dirigibles have been so unfortunate as to cause their virtual abandonment for commercial uses. If someone could invent a machine which could operate at say 10,000 feet at low cost, and with perfect safety under all conditions, the outlook would be very much improved.

In this connection, 2-way com-

munication between aircraft flying at 10,000 to 15,000 feet has often been made with only a few watts of input over a total distance of about 500 miles. This, of course, was due mainly to the greatly extended visual range achieved by the height, plus possibly a certain amount of favorable temperature inversion which, even between ground stations, frequently improves range up to several hundred per cent. for unreliable periods.

Wired Wireless

IT never rains but it pours! In the stream of new radio developments which have taken place in the last few months, yet another system is in the air for Australian listeners.

A firm has applied to the PMG for

permission to commence a system of sending radio programmes into the homes of subscribers by means of wired wireless.

Wired wireless is possibly the simplest method of programme distribution. The signals are tuned in at a central source and sent over specially erected landlines to the listeners' homes. The receiving apparatus therefore becomes merely a loudspeaker plus a simple amplifier, and a means of selecting one of the four programmes suggested at the moment.

The idea is quite an old one, and has been used extensively overseas, particularly in Europe. The company already has it in action in England, where it is claimed that 800,000 homes are connected. Subscribers there are

RADIO CROSSWORD PUZZLE No. 11

ACROSS

1. Unit of current.
4. Collision.
8. Two element tubes.
10. Radar signals.
11. Greek symbol for logarithmic decrement.
12. Scent.
14. Surrender.
15. Negative.
17. Distress signal.
18. Beam.
20. Spar.
21. Prefix for one million.
24. Portal.
27. Where we buy cheap parts!
28. Wave medium.
30. Type of converter.
31. Quiet.
32. Protects a permanent magnet.
33. Why back numbers of Radio and Hobbies are scarce!

DOWN

1. Vacuum tube.
2. Positive nucleus of atom.
3. Need for frequency checks.
5. Type of insulation.
6. Plates.
7. For checking.
9. Receiver.
10. Greek symbol for efficiency.
13. Moving part.
16. Type of switch.
19. D.F. antenna.
20. Valve!
22. Type of detector.
23. Tried out.
25. Devoured.
26. Dead-end switch (abbr.).
28. . . . effect.
29. Neutralising circuit.

BELOW: LAST MONTH'S SOLUTION

R	E	A	C	T	A	N	C	E	C	O	I	L
A	T		F	R	H		O					
D	E	T	E	C	T	I	N	G		M		O
I	U	T	U		U	C						P
O	N		S		L	C						R
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P												C
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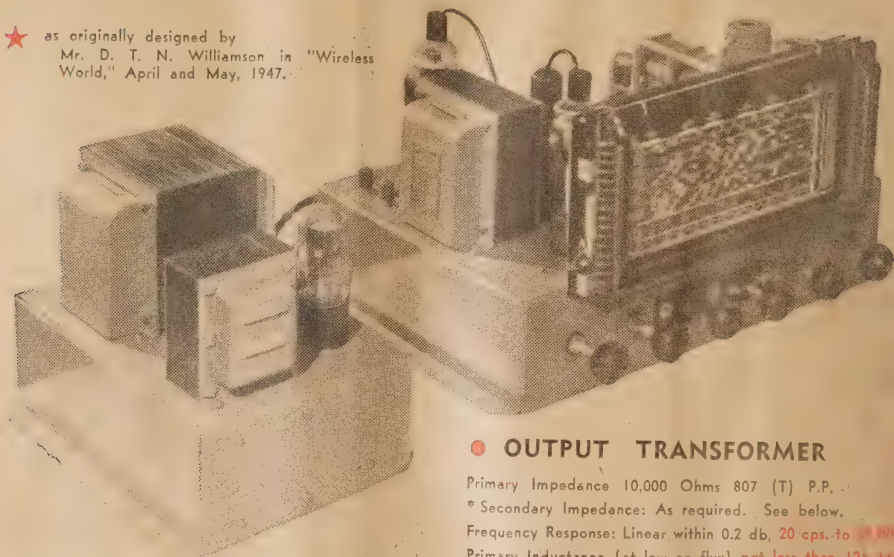
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24				25	26	27						
			28			29						
30						31						
32						33						

RED  LINE

MATCHED KITS

for THE NEGATIVE FEEDBACK AMPLIFIER *

★ as originally designed by
Mr. D. T. N. Williamson in "Wireless
World," April and May, 1947.



● OUTPUT TRANSFORMER

Primary Impedance 10,000 Ohms 807 (T) P.P.

* Secondary Impedance: As required. See below.

Frequency Response: Linear within 0.2 db, 20 cps. to 20,000 cps.

Primary Inductance (at low ac flux) not less than 125 mH.

Leakage Inductance: 17 Millihenries.

Insertion Loss: 0.4 db.

This transformer may be used to obtain a gain reduction of up to 25 db, across 4 Stages in a suitable negative feedback circuit.

★ CONDENSER INPUT POWER SUPPLY

	Type No.	Price
1 P/Trans	20453	£3 16 1
1 Choke	201515	£1 11 10
1 Choke	50825	£1 7 7

CHOKE INPUT POWER SUPPLY

(Radiotronics Circuit A515)

1 P/Trans	25563	£4 18 8
1 Choke	102512	£1 16 1
1 Choke	201515	£1 11 10
1 Choke	50825	£1 7 7

OUTPUT TRANSFORMERS

Price £5/15/2

AF8 .. 8 ohm .. V/Coil

AF15 .. 15 ohm .. V/Coil

AF10 .. 500 ohm .. Line
or as specified

RED LINE EQUIPMENT PTY. LTD.

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A GUARANTEE

OF DEPENDABILITY

charged an installation fee of £1, and a rental of 2/- per week.

In place of specially erected wires, the telephone lines and also the power mains have been used for work of this nature. During the war, carrier communication via the power mains was quite popular with American amateurs, who operated simple transmitters connected to the mains instead of sending signals into the ether. It is a technique which might yet find useful application in many fields.

There is as yet no indication of the PMG's reaction to wired wireless in Australia, but it would not be surprising to find that the present facilities were considered adequate, and that the new venture would not be looked upon with favor. It will, however, be highly interesting to see just how it all works out.

A New Valve

A NEW kind of radio set, whose music began instantly when the set was tuned on, was shown last month by the Bell Telephone laboratories.

This set has no vacuum tubes. Nothing lights, nothing even glows, and nothing gets warm. The set always goes instantly because the usual warming up of tubes does not exist.

The invention that replaces tubes is a tiny metal cylinder. Although this cylinder acts like a radio tube, there is no vacuum, no grid, no plate, no glass to keep the air away.

The entire innards of the new tube are merely two hair-thin wires that run down to the base of an empty tube, to stand on a bit of metal not much larger than the head of a pin.

This piece of metal is the secret. The metal amplifies the current that one wire carries to it, and the other wire carries away the amplified current.

The power used was less than that of an ordinary flashlight battery. The new tube is called a transistor. It is not on the market.

Laboratory scientists said this tube is also a good oscillator, that is, it will make and send radio waves. They expect this tube to do many things that vacuum tubes do, and some that the vacuum cannot.

The inventors are Drs. John Bardeen and Walter H. Brattain, working under direction of Dr. William Shockley.

Talking Typewriter

A NEW American invention is a talking typewriter. When George Coffey, its inventor, touches a key, a loud, clear voice announces the letter which has been hit. In the case of punctuation, it says "comma," "semicolon," &c.

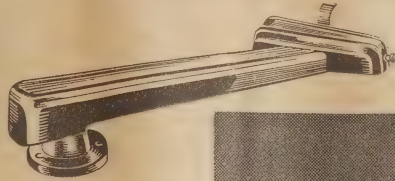
It is claimed that the machine will be useful for teaching the blind to use a typewriter, and that applications will be found for cash registers and adding machines.

The original ingredients include a 1903 Edison phonograph, a model T Ford ignition coil and an old oil burner! We understand that more easily obtained components may be used.



G.P.10 Crystal PICK-UP

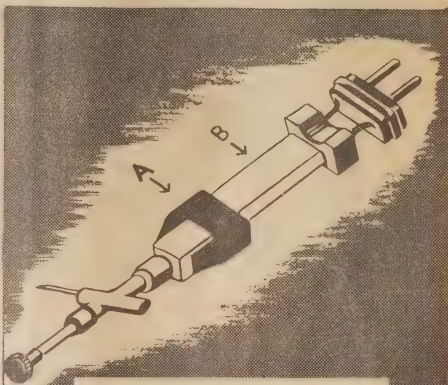
Utilises the G.P.9 cartridge, incorporating the unbreakable crystal. Housed in a smart and up-to-date moulded bakelite arm, which is of substantial section to ensure that the resonance shall be at a minimum. Its movement in both the horizontal and vertical planes is exceptionally free from stiffness or slackness, whilst a novel beryllium copper spring device in the base and bracket assembly enables the needle pressure to be readily adjusted to suit the user's preference. The ACOS G.P.10 combines purity of production with extreme reliability. A unique flexible assembly renders the crystal virtually unbreakable. Resonance-free response from 50-8,000 cps. Output 1.5v. at 1000 cps. Needle pressure 1½ oz. (adjustable). Vibration-free arm movement. Screened lead. Ninety degree lift-back for needle replacement. Fitted with convenient finger-lift for placing on recording.



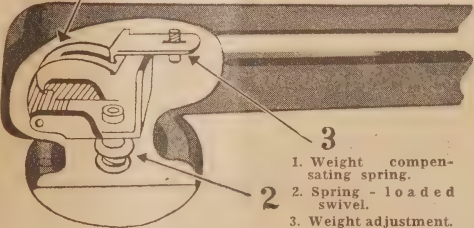
LIST PRICE
£2'8'6

No other pick-up at any price has all these Features!

★ In this unique cartridge the motion of the stylus is passed to the crystal via a rubber transmission, which, whilst transferring the lateral movements due to the record grooves, absorbs the vertical movements which occur when the pick-up is dropped on the record. Illustration—Flexible coupling "A" protects Crystal "B" against breakage.



★ featuring the ONLY Cartridge available in Australia with the UN-BREAKABLE crystal!



1 UNIQUE BASE AND BRACKET ASSEMBLY

Novel base and bracket assembly provides a frictionless movement, free from backlash. Needle pressure can be adjusted by slackening screw at (3) and moving link to required position.

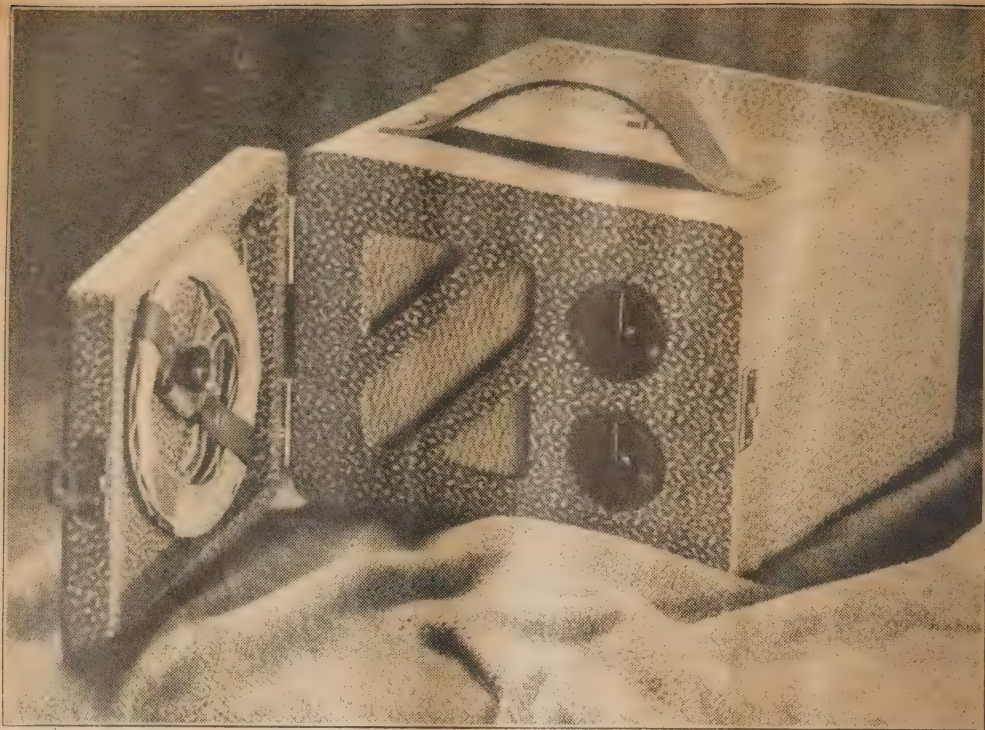
1. Weight compensating spring.
2. Spring-loaded swivel.
3. Weight adjustment.

AVAILABLE FROM ALL RADIO RETAILERS.

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AMPLION (AUSTRALASIA) PTY. LTD.

36-40 PARRAMATTA ROAD, CAMPERDOWN, SYDNEY, N.S.W.



This is how the set appears when the completed vibrator supply is clipped to the rear.

MULTI-TALKIE WITH VIBRATOR

By this time you will have read all about the "Multi-Talkie" and, we hope, been duly impressed by the possibilities of the design. But the story does not end with a set of midget batteries and an a-c power supply. This month we tell you how to build another unit which will operate the set from your car battery, taking no more current than a small light globe. Almost too good . . . but it's true!

MORE than ever we are convinced that the idea behind the "Multi-Talkie" is what the radio trade has been waiting for. You can enjoy all the facilities a personal portable has to offer, then take it home and play it for hours without worrying about the drain on batteries.

The idea of operating on a vibrator supply is no less intriguing, especially to those who are fortunate enough to possess a family car. Perch the set on the running-board, plug into the electrical wiring, and enjoy the programme for as long as you like, again without worrying about battery replacements. The set will not draw much more than half an amp from the car accumulator.

If you are a caravan or camping enthusiast, the same economy will appeal. An ordinary auto set is all

right for listening to the news at odd intervals, but you can't hear it very well outside the car and you can't leave it run for hours on end—at least not without flattening the battery.

With the "Multi-Talkie," father can have his Parliament, mother can have the women's session, and the family its serials, all within the tent or caravan. The operating cur-

rent is so low that a trailing length of power flex to the car battery will not make much difference to the performance.

At the outset, we tried the "Multi-Talkie" on a commercial vibrator supply, which has built-in filtering for both the high tension and filament circuits. The only addition was a 5000 ohm resistor in series with the B-plus lead to drop the voltage to a more suitable figure. Performance was excellent, with no trace of hash. There is no reason why you should not follow suit, if you have a vibrator power supply on hand, or feel like buying one ready-built.

However, we felt that the story would not be complete unless a vibrator unit were constructed small enough to fit into the original power

*by Raymond
Howe*

There is always an element of uncertainty in vibrator-powered equipment, particularly, as in this case, where space is at a premium. The constructor can only follow approved methods and, if trouble with hash occurs, treat each case on its own merits. However, if you duplicate the original design in detail, no serious trouble should be encountered.

REMOVING HASH

Much has been said in previous articles about the precautions necessary to eliminate the interfering "hash" associated with this type of supply. In most of the sets described in those articles, the vibrator supply was mounted on a sub-chassis which was insulated from the main receiver chassis and connected thereto by a single earth bond, strategically arranged.

In this case the vibrator supply is mounted in a completely separate cabinet, but it is still important to determine experimentally the most effective point of earth bonding between the metal box and the receiver chassis.

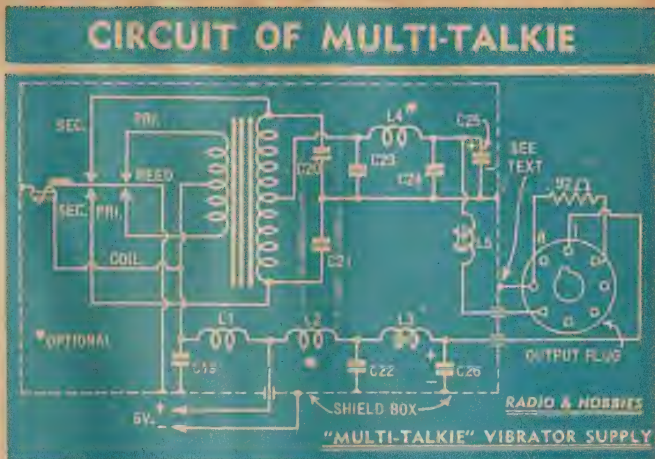
This metal box needs to be of appropriate dimensions in order to fit snugly into the same-sized cabinet as that which housed the a-c power supply for the "Multi-Talkie." External dimensions, not including the lid, are 6 3/8-in. by 4 3/8-in. by 2 1/2-in. The lid fits outside this again, and the "turn-down" should be such as to provide a good metal-to-metal contact around the whole perimeter of the box.

SUB-CHASSIS

The remaining piece of metalwork is a sub-chassis, and a good idea of its shape may be obtained from scrutiny of the photographs.

It was made from a piece of aluminium which measured 7 3/8 in. by 3 3/8 in. A 1/2 in. bend was made around the entire perimeter to form a flange, to which the transformers and the chokes attach, and by which the sub-chassis is attached to the inside of the metal box.

At a point $4\frac{1}{4}$ in. from one end, a 90deg. "V" is cut out of the flange on each side of the sub-chassis. The bottom of this "V" cut should be flush with the surface of the chassis



The circuit of the vibrator supply.

so that, when the chassis is bent at right angles, the inside edges of the "V" cuts meet.

In the construction of the metal box and the attachment of the sub-chassis it is wise, for obvious reasons, to use countersunk head bolts. Aluminium is the easiest metal to work, although, of course, any type of metal can be used.

A hole is required in the top right-hand corner of the box, viewed from the front, for the output leads and the plug. Allow a liberal clearance for the plug to pass through, to overcome any problems of alignment with the power input socket of the set.

The size of the wooden cabinet and that of the metal box should be such that back cover of the cabinet holds the lid of the metal box and the complete unit firmly in place.

Now a word concerning the components. To meet the problem of space, a local manufacturer agreed to produce for the purpose a transformer which would provide the 90-odd volts required at 15 to 18 mA, but with a considerable reduction from conventional size. At the same time, a suitable high tension choke was produced to the same physical

dimensions and with adequate inductance at the specified current drain. Specifications for these components are being supplied to all manufacturers.

The result, therefore, is that the transformer, the HT filter choke and the iron-cored LT filter choke are of the same physical dimensions, and fit nicely into the limited space in the manner illustrated by the photographs.

SOLDERING TIP

To attach these components to the sub-chassis, it will be necessary to bend the normal mounting lugs downwards. It is wise to take the "chill" out of the metal with a soldering iron before this is done, as otherwise the lug may break before the 90deg. bend is complete. However, if approximately two-thirds of the bend is made at the point of the original angle and the remaining portion at a fraction of an inch further down, the risk of breakage is minimised.

Before mounting the transformer and the two chokes into place, drill holes in the sub-chassis for the leads thereto and for the single-hole mounting of L2 underneath L3, the

PARTS LIST

- 1 Metal box complete with lid, and inside sub-chassis, outside dimen. 6 3/8" x 4 3/8" x 2 3/4".
- 1 Vibrator transformer, 90v, 15-20 mA.
- 1 6 volt synchronous vibrator cartridge.
- 1 92 ohm resistor (or 100 ohms).

CONDENSERS:

- C19 .1 mfd. 200 volt tubular.
C20 .02 mfd. 600 volt tubular.
C22 .1 mfd. 200 volt tubular.
C23 .01 mfd. mica
C24 .01 mfd. mica

- C25 8 mfd. 525 PV electrolytic (mid-
get type).
C26 500 mfd. 12 PV electrolytic (tubu-
lar type).

CHOKES:

- L1 and L2 low tension RF chokes.
L3 iron-cored low tension choke.
L4 RF choke.
L5 30 Henry 20mA. filter choke.

SUNDRIES:

- 1 6 pin wafer socket, 2 upright-mounting tag strips, 1 octal plug, 1 2 and 3 mil spaghetti, shielded lead, hook-up wire, solder lugs, nuts and bolts, &c.



**"CAPE HAWKE
CALLING, SIR!"**

Designed to provide reliable oral communication for small craft for limited distances (intership or land), the radio telephone set has proved its usefulness by its convenience and efficiency.

Easily operated and small in size, it derives its power from a 24v. battery, and can be installed in a very limited space. The radio telephone has a range of 50 miles, and can be remote controlled from up to 50 yards distance.

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IRC RESISTORS

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iron-cored LT filter choke. Place a countersunk head bolt through the hole.

Similarly, when securing L5 in position, place a two-terminal tag strip under the nut of its inside securing bolt. This strip carries the connections to L2, L3, C22 and C26 from the incoming and filtered outgoing 6-volt lead.

VIBRATOR WIRING

The next step is to wire the vibrator primary and secondary circuits. Mount the vibrator mounting socket as low down as possible on the vertical portion of the sub-chassis. By using the socket-securing bolts, mount two tag strips, one on each side. The one to the rear is a 6-tag size, while the one at the inside front is a 2-tag size. Not all of the tags of the larger size are required, but the length is necessary in order to allow for short leads to L1 in the interests of rigidity. To this end, the top tag of this strip carries the incoming positive lead from the 6-volt battery.

Following completion of the wiring of the primary and secondary of the transformer and the reed and driving coil of the vibrator, the RF mica bypass condensers, C23 and C24, are wired into place. The next step takes in C20, C21, the RF choke L4, and, finally, C25, C19, L1 and C22. Wire in C22 on the underside near the 2-tag strip. Finally, insert the vibrator cartridge, mount L2 and C26, and the sub-chassis is ready for securing in the metal box.

Keep all earth connections associated with the above portions of the circuit, except that of C22 and C26, to the vertical portion of the sub-chassis.

H.T. POLARITY

The connections between the vibrator cartridge and transformer will determine the polarity of the high tension output voltage. At this stage, therefore, it is necessary to connect the supply in the correct polarity to the accumulator and take a quick reading on a multimeter to note whether the high tension output is positive or negative with respect to chassis. If it is positive, you are lucky. If it is negative, the connections to either the primary or the secondary winding will need to be reversed.

High tension and filament supply are both conveyed to the receiver chassis by a suitably wired octal plug.

The power plug to the set changes the filament network to suit the six-volt supply. When the a-c power supply for this set was designed, it was merely necessary to provide the required voltage for full series arrangement, namely seven odd volts.

With a maximum of six volts available from the accumulator, it is desirable to rearrange the filament network from series to series—parallel with a dropping resistor, in order to apply the full rated filament voltage to all valves.

This has been achieved by con-

necting the filtered six-volt positive lead to pin 1 on the output plug of the supply, which is then connected via the supply socket to pin 5 of the 3V4 socket.

Tracing out the filament network on the circuit of the receiver, published in last month's issue, you will see that four valve filaments are in series across the six volts from the battery. The fifth filament, that is, between pins 5 and 7 of the 3V4, is connected in series with the 92 ohm dropping resistor across the same supply. The value of this resistor is such that the required 1.4 volts appears across pins 5 and 7.

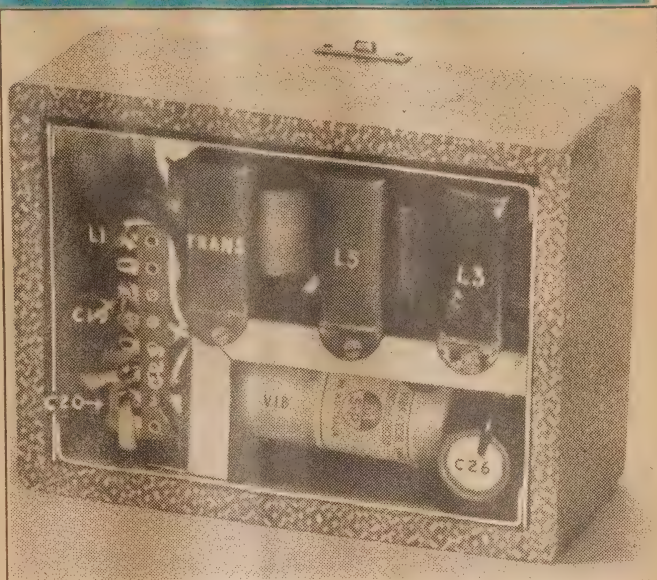
RESISTOR SIZE

This resistor may be of $\frac{1}{2}$ watt size and may be connected directly between pins 2 and 7 of the vibrator supply output plug. In this case, it would be wise to enclose completely the resistor in 3 or 4 mil spaghetti to avoid an accidental "short" when the receiver and power supply are clipped together. Alternatively, the resistor could be supported to a 2-tag strip mounted on the rear mounting bolt of the choke, L5.

Assuming that the wiring has been completed and checked, and the sub-chassis firmly secured in the metal box, the final task is to select the point of attachment of the earth bond between the receiver chassis and the metal box. This has an important bearing on vibrator "hash."

As this earth bond is also the return for the HT and LT circuits, be sure to maintain continuity of circuit while selecting the best point for permanent attachment. In our case, the best point was in the vicinity of the hole for the output

THE POWER UNIT IN CABINET



Here is the power supply in its metal case, which in turn slips into the small cabinet to match that of the set itself.

plug. Accordingly, a solder lug was placed on the bolt just above the hole, and the earth lead soldered thereto.

During this final test, make sure that the lid is making a good electrical contact around the outside of the metal box. This is an extremely

important point, and we cannot emphasize it too strongly. Interference from "hash" will almost certainly be encountered unless the lid is in good and firm contact at all points around the outside edge of the metal box.

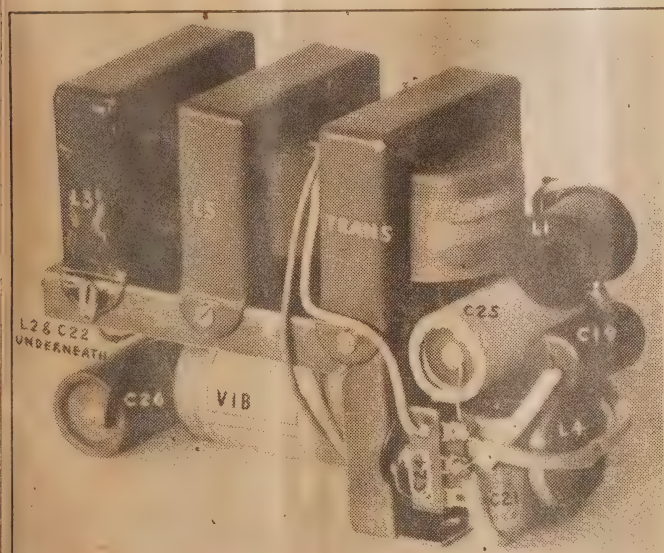
It was found that, under these circumstances, the leads to the battery did not require shielding, and hence may be run in ordinary power flex. The current drain hovers around .6 amperes, which also permits the use of this ordinary flex without having to worry about excessive voltage drop.

WATCH FOR SHORTS

One final point is worthy of mention. With the set operating either from the a-c or the vibrator power supply, be careful not to "short" to chassis with meter test prods, screw-driver or the like any "hot" portion of the filament network. Such "hot" points would be all socket filament lugs, and the filament circuit wiring on the set supply socket.

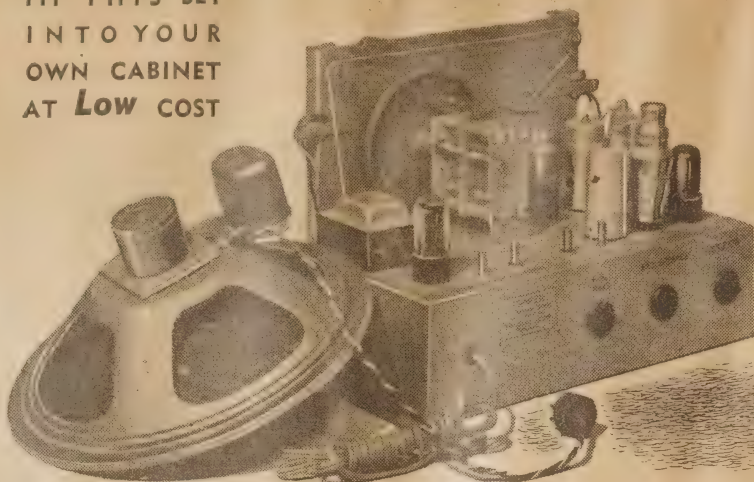
An accidental "short" to chassis of any of these points, while the set is in operation, would result in more than the rated voltage being applied to some valve filaments. The results may be disastrous.

But don't be put off by this rather morbid warning. In the normal way, no such tragedy is likely to happen. What is more to the point, the vibrator supply works very well indeed, and adds immensely to the practical value of this little set.



The supply mounted on its chassis ready to be fitted to its metal case.

FIT THIS SET
INTO YOUR
OWN CABINET
AT **Low** COST



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Sky Knight

FULL SIZE 5-Valve WORLD
RANGE UNIT for

£19'19'-

- Completely assembled and Tested.
- Using Standard Components.
- Easy terms in Metropolitan area of Sydney

This new Sky Knight foundation unit should prove a boon to anyone interested in building their own set. It incorporates many of the features that have made the Sky Raider and Sky Master sets famous. Standard components are used throughout and the chassis comes to you completely assembled and pre-tested, ready to be placed in a full size console cabinet. Easy terms can be arranged within the Metropolitan area of Sydney.

*We can supply a modern console
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Call in and see the Sky Knight at our only address.

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Telephone: BX2691-2-3.

Here are the
Sky Knight Features:

The Sky Knight is a full size 5-valve World Range unit, Complete with 12 inch Permag. Speaker.

★

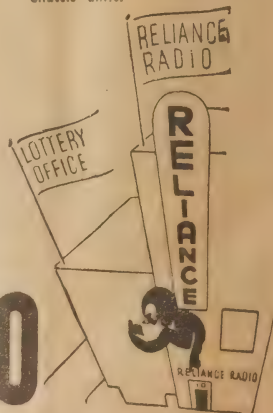
Standardized components have been built-in to a modern tested circuit. Valves included.

★

Provision for extension speaker, FM plug-in, Pick-up terminals, Gramo switch. Large modern calibrated dial. Flywheel drive.

★

We have available a limited number of Electric motors. Pick-ups and Record Changers of best imported types, supplied at special prices with chassis units.



"YOU can be sure of THIS door."

BOOK REVIEW
COLUMN

"AUSTRALIAN INSTRUMENTS INDEX," 1947. Published by the Australian Society of Instrument Technology, the index is intended as a reference for scientific workers.

Appreciating the need for such a reference, the publishers contacted nearly 3000 manufacturers and agents to determine the nature and scope of all instruments and allied equipment available in Australia, whether of local or overseas manufacture. The result of this investigation appears as a comprehensive directory indicating the instruments available and sources of supply.

For ease of reference, the instrument titles are arranged alphabetically, and a code system gives the key to firms from which supplies may be obtained.

A comprehensive advertisers' section at the front and back is a further source of general information. Australian price for the present edition is 7/6. The publishers anticipate that further editions will be released from time to time as the occasion demands.

* * *

"FUNDAMENTALS OF RADAR,"
BY STEPHEN A. KNIGHT, FRSA.
Published 1947 by Pitman and Sons, 128 pages, hard cloth cover.

In compiling this book the purpose of the author has been to present radar, not as something fundamentally new, but as a logical development from accepted radio circuit techniques. It should therefore form an excellent introductory work for those who have not before had reason to study radar principles.

Chapter 1 is entitled simply "How Radar Works" and, in it, the reader is introduced to the simple elements of elevation, bearing and display on a linear trace.

Chapter 2 comes more to grip with the subject and examines in detail trigger and pulsing circuits which are the heart of radar equipment. Then follows a discussion on saw-tooth generators.

Chapter 4 introduces the reader to cathode ray tubes, methods of deflection and allied circuits. This leads naturally into a discussion of pulse transmitters, then pulse receivers and their combination with cathode ray equipment to determine and display range. Last but not least, comes a chapter on directional aerial arrays, which form an integral part of any radar system.

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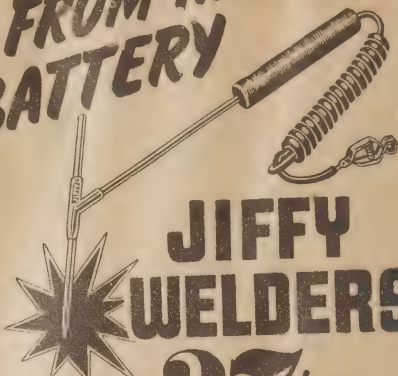
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FOR THE JUNIOR EXPERIMENTER

Here is a second article on coils, this time of the home wound variety. We tell you something of wire gauges, methods of winding and various points to watch.

AT the outset it is well to repeat last month's warning that a coil is not just a few turns of wire on a round tube. It is a radio component, which possesses inductance as its major property and a number of other secondary characteristics, which can make or mar the performance of a receiver. When winding a coil, therefore, adhere as closely as possible to a reputable set of specifications, departing from them only as a matter of necessity.

COIL DATA

Published coil data usually list the diameter of the former, the type of wire to use and the number of turns. Where there is more than one winding to the complete coil, the above data is given for all windings, together with their relative positions and direction.

In most cases the grid winding is tuned, so that its inductance governs the frequency range of the receiver. In a sense, therefore, it can be regarded as the most important winding of a complete coil.

Let us assume, then, that the de-

signer specifies a grid winding of 110 turns of 32 SWG gauge enamel wire on a 1 1/4 in diameter former. Three questions are likely to arise from this apparently simple data:—

1.—What is meant by the initials SWG?

2.—I think some wire on hand is of suitable gauge, but how can I be sure?

3.—I have some (?) gauge wire available, and want to know whether it will be suitable?

In conjunction with this article we have prepared a set of wire tables which are available through the shilling query service. Address your request to The Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney, and enclose stamps or a postal note to the value of one shilling.

Let us take the questions in order:

The initials "SWG" mean Standard Wire Gauge and apply to the standard which is accepted in England. Wire of American origin, on the other hand, normally conforms

to the "B. & S." gauge, or to the American Wire Gauge (AWG), which is substantially the same as B. & S.

The two main systems, SWG and B. & S. (or AWG), are similar, in that heavy wires are designated by the lower numbers, while the higher numerals—for example, 40 gauge—indicates the finer wires. There is a difference between the standards, however, in that SWG wires are slightly heavier than B. & S. wires of the same gauge number. SWG gauge 33 is approximately the same as B. & S. gauge 30, and similar differences exist throughout the range.

Winding specifications are therefore not complete in detail unless the gauge number is followed by the initials SWG, AWG or B. & S.

In winding transformers and chokes, where winding space is a major consideration, it is essential to use the exact wire gauge specified, as a slight departure from it may make all the difference between a winding fitting or not fitting into the allocated space.

With ordinary solenoid coils, matters are not quite so critical, and a small discrepancy in wire dimension will simply result in a winding slightly longer or slightly shorter than anticipated.

Provided the difference is not greater than 25-30 per cent., the effect on inductance and tuning range will not be very great.

However, it is possible to be quite definite about matters of gauge or winding space by making use of wire tables. These are printed in most textbooks and show details like diameter, cross-sectional area, weight per thousand feet, diameter with various forms of insulation, turns per inch of former length and turns per square inch section for multi-layer winding.

USING TABLES

It is not difficult to extract useful information from these tables. Knowing wire gauge, insulation and number of turns, it is possible to calculate quite accurately the space any particular winding will occupy. Or, if B. & S. wire is available and specifications are for SWG gauge, it is possible from the data to select equivalent gauge numbers.

The use of wire tables also offers the answer to the second question, relating to wire of unknown gauge. Simply close-wind enough wire on a pencil to occupy an exact half-inch or inch of winding length, count the number of turns and refer to the tables. If it is found that 45 turns

S.W.G. No.	Diameter (mils)		Turns per inch (exact winding)					
	*Enam.	D.C.C.	Bare	Enam.	S.C.C.	D.C.C.	S.S.C.	D.S.C.
10	132	142	7.81	7.63	7.35	7.04	—	—
11	120	130	8.62	8.33	8.07	7.69	—	—
12	108	118	9.62	9.26	8.93	8.43	—	—
13	96	106	10.87	10.42	10.00	9.43	—	—
14	84	94	12.50	11.90	11.36	10.64	—	—
15	75.5	84	13.89	13.25	12.66	11.90	—	—
16	67.5	76	15.63	14.81	14.03	13.16	14.93	14.71
17	59	68	17.86	16.95	15.87	14.71	16.95	16.67
18	50.7	59	20.83	19.72	18.18	16.95	20.00	19.61
19	42.6	51	25.00	23.47	21.28	19.61	23.81	23.26
20	38.5	47	27.78	25.97	23.81	21.28	26.32	25.64
21	34.3	43	31.25	29.15	26.32	23.26	29.41	28.57
22	30.0	39	35.71	33.33	29.41	25.64	33.33	32.26
23	25.7	34	41.67	38.91	34.48	29.41	38.46	37.04
24	23.6	32	45.45	42.37	37.04	31.25	42.55	40.00
25	21.5	30	50.00	46.51	40.00	33.33	46.51	43.48
26	19.4	28	55.56	51.55	43.48	35.71	51.81	48.78
27	17.7	26.4	60.98	56.50	46.73	37.88	56.50	52.91
28	16.0	24.8	67.57	62.50	50.51	40.32	62.11	57.80
29	14.8	23.6	73.53	67.57	53.76	42.37	67.11	62.11
30	13.4	22.4	80.65	74.63	57.47	44.64	72.99	67.11
31	12.6	21.6	86.21	79.37	60.24	46.30	77.52	70.92
32	11.7	20.8	92.59	85.47	63.29	48.08	82.64	75.19
33	10.9	20.0	100.00	91.74	66.67	50.00	88.50	80.00
34	10.0	19.2	108.7	100.0	70.42	52.08	95.24	85.47
35	9.1	17.4	119.0	109.9	80.65	57.47	103.1	91.74

Section of a typical copperwire table, in this case for SWG gauge.



VALVES AND THEIR APPLICATIONS

By M. G. SCROGGIE, B.Sc., M.I.E.E. (Eng.)

No. 2: Mullard TWIN TRIODE ECC32

THERE are quite a number of special circuits, such as multivibrators and push-pull drivers, that use a pair of similar triodes; for these purposes twin triodes usually save cost and space.

Each triode in the ECC32 is a normal type with a μ of 32 and r_p of 14,000 Ω . Used with a 0.1 M Ω coupling, the voltage gain is nearly 30, and varies little with the supply voltage, which chiefly affects the signal output obtainable. For low distortion (2.3%) the output at 200 volts is 45 V peak, and at 400 V is 115 V peak. The ECC32 is not restricted to designs with common cathodes; and the capacitance between anodes is less than 1 pF. In a 2-stage amplifier, the grid pin farther from the heater pins should be used for input.

For driving push-pull amplifiers or providing symmetrical c.r.t. deflecting voltages, there are several well-known phase-inverter circuits. The gain obtainable from most of them, using a pair of similar valves, is approximately equal to that of one ordinary stage. In the cathode-coupled or Schmitt circuit it is only about half as much, and a negative voltage has to be provided; but it is a very versatile sort of circuit, and especially suitable for c.r.t. deflection.

Ideally, the signal anode currents would be equal and opposite, so would cancel out in R_k . In practice they must be sufficiently unequal for their difference to give enough voltage drop in R_k to drive V2 oppositely to V1. To minimize this inequality, R_k should be large—of the same order as R_{a1} and R_{a2} —and the voltage gain per stage also large. With the ECC32, for example, the difference in outputs need be only about 5%; and this, if not negligible, can be corrected by making $R_{a1} < R_{a2}$.

A feature of this circuit is that if one wants to mix another signal in the balanced output, without coupling the two signal sources, the grid of V2 is available for doing so.

It is obvious, too, that by coupling the anode of V2 to the grid of V1 it can be made to generate sustained oscillations, of a type depending on the couplings. If a 2-phase output is not needed, R_{a1} can be short-circuited. A very stable constant-frequency oscillator, using an untapped inductor, may be based on this arrangement, which is easily seen to be an earthed-grid triode driven by a cathode follower. Used as an amplifier, it is capable of covering a very wide frequency band.

The following are a few references to details of the foregoing schemes:

"Cathode-Coupled Push-Pull Amplifiers," O. S. Puckier, *Electronic Engineering*, July, 1946.

"The Cathode-Coupled Double-Triode Stage," Emrys Williams, *Electronic Engineering*, July, 1946.

"Cathode-Coupled Oscillators," M. S. Wheeler, *Wireless Engineer*, Feb., 1946.

"Cathode-Coupled Wide-Band Amplifiers," G. C. Sukhai and A. C. Schroeder, *Proc. I.R.E.*, Oct., 1946.

"Self-Balancing Phase Inverters," M. S. Wheeler, *Proc. I.R.E.*, Feb., 1946.

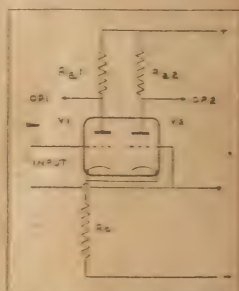


FIG. 2. CATHODE-COUPLED CIRCUIT



This is the second of a series written by M. G. Scroggie, B.Sc., M.I.E.E. (Eng.), the well-known English Consulting Radio Engineer. Reprints for schools and technical colleges may be obtained free of charge from the address below. Technical Data Sheets on the ECC32 and other valves are also available.

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of a particular enamelled wire occupy half an inch, then it is reasonable to assume that the wire is either 33 SWG gauge or 30 B. & S. gauge.

Cotton-covered wire occupies more space than enamelled wire, owing to the thicker insulation, but appropriate columns in the tables will give this information as well.

The third question related to the use of a gauge other than that specified. What will be the effect on the ultimate characteristics of the coil?

As mentioned earlier, minor variations in gauge and winding length will have no drastic effect on characteristics, at least of a simple tuning coil for a crystal or regenerative receiver. It is, therefore, in order to use any wire which will give a winding not more than 25-30 per cent longer or shorter than originally envisaged. You can check on winding length quite simply by reference to wire tables. The same number of turns must be used, of course. So much for winding wires.

COIL DIAMETER

Another matter which often concerns readers is the effect of varying coil former diameter. For example, specifications may call for a 1½ in. diameter former, whereas the constructor may be able to purchase only 1¼ in. former. Is this likely to be of any use?

Once again, it is wise to avoid discrepancies from specified data greater than about 25 per cent. On this basis, it would be feasible to substitute either 1 in. or 1½ in. former for a 1¼ in. specification, but some allowance would need to be made for the effect on inductance. Broadly speaking, if the diameter is increased by a certain factor, a proportionate reduction must be made in the number of turns—and vice versa.

Thus, increasing the former diameter from 1¼ in. to 1½ in., represents a proportionate increase of one-fifth, or 20 per cent. A reduction by this same factor would be necessary in the number of turns, so that a 110-turn winding would reduce to about 83. Reducing the diameter, on the other hand, from 1¼ in. to 1 in., would entail a winding of about 137 turns. This is a simple approximation, but it is near enough for all practical purposes.

SUMMARY

Summing up the foregoing, we can extract the following general rules—

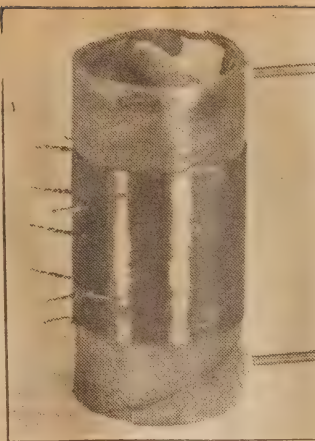
1. Adhere to exact specifications if possible.

2. Avoid using wire gauges or insulation which will involve an increase or decrease in coil length greater than 25-30 per cent. The optimum number of turns will not be greatly affected.

3. Variations in former diameter up to 25 per cent. are permissible, but an inversely proportionate change must be made to the number of turns.

4. The number of turns is always the critical factor, not the exact space which the winding occupies on the former.

All the foregoing discussion centres around the grid winding, which is normally tuned. Auxiliary



A typical home-wound coil.

windings, such as the aerial primary, or the reaction winding, are rather less critical, and it is generally possible to use wire of similar or finer

gauge than specified, maintaining the specified number of turns and the correct spacing from the grid winding. If variations are necessary in grid winding turns, due to coil former diameter, a proportionate change must be made in the turns on the auxiliary windings.

In most cases, auxiliary winding are wound in the same direction as the grid winding, and, unless otherwise specified, it is essential to adhere to this procedure. The connections to the winding are equally important.

When preparing to wind a coil therefore, begin by studying the specifications, and make quite sure you know what is required. Check over your "stocks" of coil former and wire and make allowance for any variations from the specifications. Estimate the length and position of each winding, and mark the former accordingly.

The grid winding should be put on first, so begin by punching or drilling two holes through the former about ½ in. apart, at the start of the winding. Push the end of the wire in through one hole, and out the other



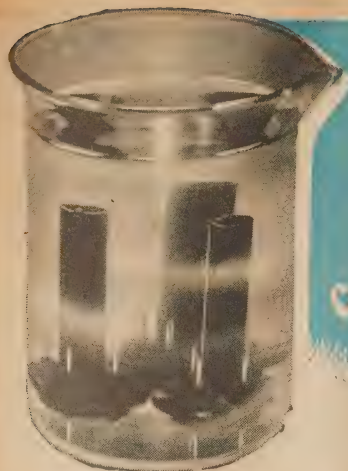
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1. Three lightly waxed condensers were selected at random, their "Q" factor checked and then immersed in water under similar conditions. After two hours the "Q" factor had altered very little but within six hours, the "Q" factor had dropped to a very low level.

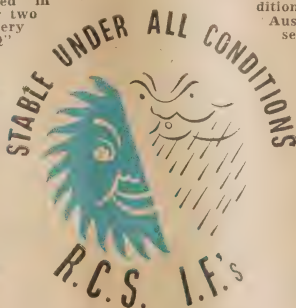
2. Three heavily waxed condensers were selected at random and immersed in water under similar conditions. After two hours the "Q" factor had altered very little but within six hours, the "Q" factor had dropped to a very low level.

3. Three of the same type of condensers were selected at random, then moulded into a Polystyrene coil former under a process over which R.C.S. have patents pending. These condensers were then immersed in water and their "Q" factor checked every two hours. These tests were carried out by our chemists over a period of three full days and nights and at the end of that time, the "Q" factor of these condensers was unchanged. This proves conclusively that under the extremities of climatic conditions experienced by radio apparatus in Australia, only R.C.S. moulded-in condensers can maintain a stable "Q" factor.

RIGHT



WRONG

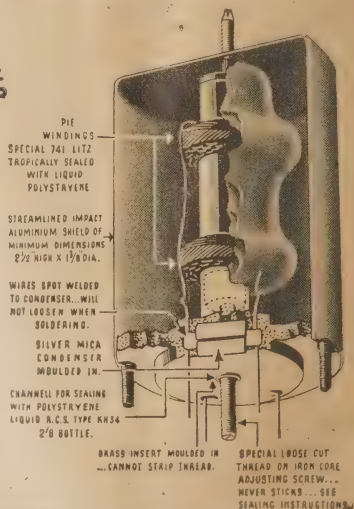


The illustrations at left show right and wrong I.F. circuits. Whilst you may have a coil of very high "Q," this is useless if unstable condensers are used in conjunction as the variation in atmospheric conditions lowers the "Q" of the condenser and consequently the I.F. Remember, Polystyrene in which R.C.S. condensers are moulded, has the highest known "Q" for insulating material, being equal in this respect to quartz.

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FOR THE JUNIOR EXPERIMENTER

(Continued from Page 33)

leaving about 3in. loose for connection to the external circuit. It is just as well to tuck this loose lead into the end of the former, so that it will not accidentally be twisted off.

Begin winding, keeping each turn hard alongside its neighbor, and the wire taut. Above all things, don't release the tension on the wire, or your grip on the former, or the wire will slip, and you will have to begin the job all over again.

COUNT CAREFULLY!

Count the turns as you wind, and, when the required number is in place, check carefully on your count. Snip the wire three or four inches from the end of the winding, punch two more holes through the former and thread the lead through them, as before. A spot of wax or acetone cement prevents any risk of slipping.

One can then proceed to add the auxiliary windings, being most careful to observe the correct number of turns and the direction of winding.

One of the "snags" about fine-wound coils is the risk of breaking off the leads, particularly if the coil is the subject of much handling or experiment. With this in mind, it is a good idea to fit half a dozen terminal lugs to the former, at least on a broadcast coil, and terminate the wires appropriately on them.

POSSIBLE VARIATIONS

When the coil is installed ultimately in a receiver, small variations may be necessary to achieve optimum results, for example, an increase or decrease in primary or reaction turns. After such adjustments have been made, it is well to "dope" the coil to prevent turns from breaking. Coil "dope" can be purchased, which is simply painted on and allowed to dry. Shellac varnish can be made by soaking shellac flakes for several hours in a jar of methylated spirits. Or you can immerse the coil in a can of hot paraffin wax.

The coil former, by the way, can be anything from a cardboard mailing tube to bakelite or trolitul. For ordinary broadcast coils the virtues of these materials are as much mechanical as they are electrical.

COIL WINDING DATA

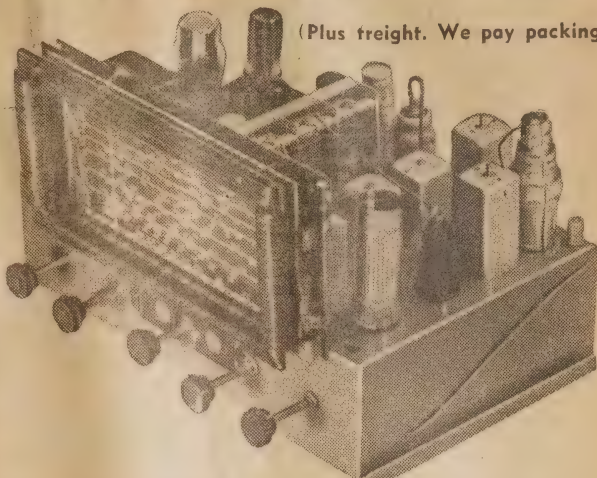
Space does not permit the inclusion of a complete set of coil specifications, but we can supply through the shilling query service a page of coil winding data for small receivers.

This covers the coil requirements for regenerative sets, with or without an R.F. stage, and is quite useful for home constructors.

But don't ask us for coil winding data for superhets. You will save yourself a lot of worry and possibly expense, by buying the commercial article. You simply cannot duplicate by hand the results achieved by modern factory-wound superhet coils and I.F. transformers.

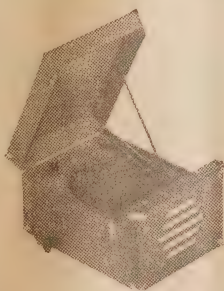
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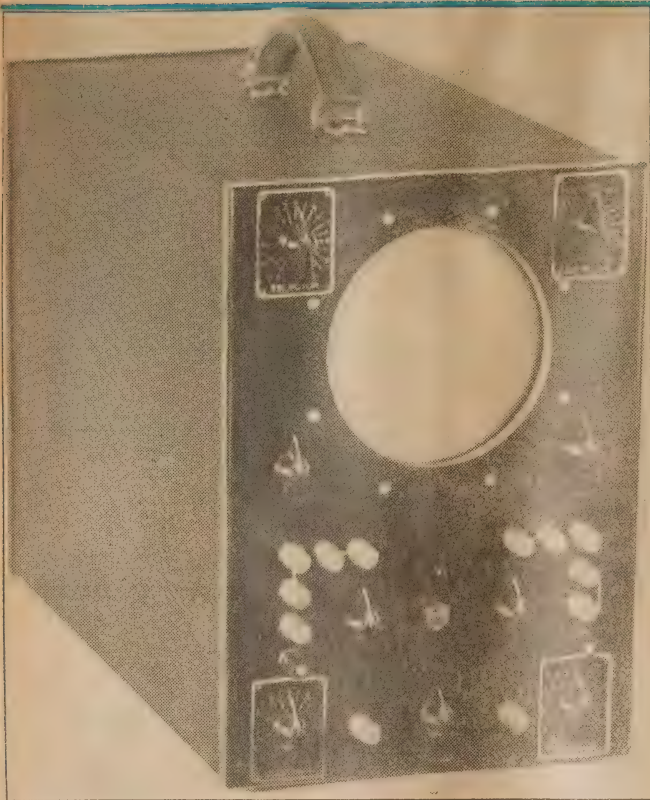
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A typical cathode ray oscilloscope such as would be used for tests detailed in this article.

the side of the case. Their effect on the spot is obvious.

For testing purposes most oscilloscopes have terminals on the front panel, which give direct access to the deflector plates, generally one plate of each pair in a small oscilloscope, or all four plates in a more advanced design.

The application of a d-c voltage to any one plate will cause the spot to be displaced horizontally or vertically according to the connection and order of the applied voltage. It is possible to utilise this effect and employ an oscilloscope directly to indicate voltages positive or negative with respect to earth. The indication of voltage is by no means an exact measurement, but it is often accurate enough, and it is achieved without placing an appreciable load on the circuit under test.

It is thus possible to note the order of voltage on an AVC line, a particular grid, or any other valve element which is supplied through a high impedance circuit. In the normal way the test is accomplished by bonding the chassis of the oscilloscope to that of the equipment under test and connecting the free deflector plate to the particular circuit point.

The amount by which the spot is deflected is governed by the "deflection sensitivity" of the cathode ray tube under the particular operating conditions.

By way of example, the 906 type

HOW TO USE YOUR C.R.O.

Indications are that many readers have embarked upon the construction of a cathode ray oscilloscope, following upon a recent series of articles and the release of 5BPI tubes from disposals. In line with numerous requests, we present this brief article which outlines the uses of an oscilloscope for testing amplifiers and modulators.

IT is a mistake to regard an oscilloscope as a magical device which will solve routine service problems more rapidly. Rather is it a very specialised instrument which makes certain electrical phenomena visible and reveals circuit conditions which are not so apparent on other equipment. Its special application is to audio circuits as an adjunct to the tracing of distortion and hum and observing gain, and the determination of power output.

At the outset it is necessary to form a clear picture of the relationship of each control to the behavior of the spot on the tube screen. Once acquired, this sense will enable the operator to apply the instrument to all kinds of odd tests, perhaps not envisaged at the time of construction.

In the absence of voltage on the deflector plates, the spot takes up a position somewhere near the centre of the tube screen, the exact location depending on normal variation in tube manufacture. It is generally desirable to have the initial spot position exactly central and, for this purpose most instruments incorporate "spot shift" controls either on the front panel or accessible through

of tube has a deflection sensitivity of one set of plate of 0.334 millimetres per volt d-c. This is with a voltage of 1000 applied to the "gun." In more easily recognised units this means that approximately 76 volts d-c are required to displace the spot by one inch from its initial position. On the other set of plates the same displacement would be evident with a slightly lower voltage—about 73 to be precise.

By way of comparison, a 5in. tube is somewhat more sensitive and, with 1500 volts applied to the anode, the sensitivity is 0.404 millimetres per volt d-c. This represents 63 volts d-c for one inch deflection on one set of plates and 57 volts for the same deflection on the other plates.

The above calculation can be made

by **W. N.
Williams**

TYPICAL C.R.O. WAVE FORMS

for any other tube for which data is available, but the figure can be determined experimentally by applying a known voltage to the deflector plate and measuring the displacement of the spot from its position prior to application of the voltage. The displacement is linear across the scale, so that, if 57 volts move the spot by one inch, then a two-inch displacement would be produced by 114 volts, and so on.

ALTERNATING VOLTAGE

Exactly the same measurement can be made of an alternating potential, except that the spot will oscillate rapidly to and fro to produce a continuous line on the screen. In this case the length of the line is determined by the peak excursion of the voltage, generally with respect to earth. Thus, an alternating potential equal to 57 volts peak might produce, say, a two-inch line on a 5in. tube, representing 57 volts positive and 57 negative with respect to earth. Assuming a sine wave, the RMS value of this peak potential would approximate 40 volts. These figures, of course, are mentioned purely by way of illustration, but the relationship can be seen between d-c spot shift and the length of trace with a-c applied.

It is very helpful for this and other reasons to obtain a sheet of celluloid and to carefully engrave it with vertical and horizontal lines spaced 1-10th inch apart. The lines can be scratched with a sharp instrument and every fifth line, representing one half-inch graduation, filled with black ink. The trace can be seen quite clearly through such a scale and the length of line or displacement of spot determined directly in decimals of an inch. If you spend a half-hour or so recording the deflection sensitivity of your instrument on both sets and plates for a-c and d-c it will thereafter constitute a handy high-impedance voltmeter for a limited range of potential.

EFFECT ON SPOT SHIFT

One small point is worth special mention. If the voltage under test is applied between chassis and one deflector plate, the spot shift control on that plate may not operate and measurement must be taken simply between the initial position of the spot and that much it assumes when the voltage is applied. Alternatively, it is often possible to apply the unknown voltage between the deflector plate and its normal return circuit so that the spot shift will operate. Make sure, through all these tests, that you do not leave a bright spot stationary on the screen for longer than necessary, since the screen material can be damaged by so doing. So much for voltage measurements.

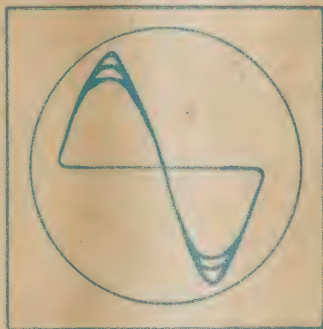
In many cases one is interested not so much in the exact order of an alternating voltage, but in its waveform and the function of the instrument becomes one of making the



A single sine wave looks something like this on the CR tube screen. The return trace may or may not be visible.



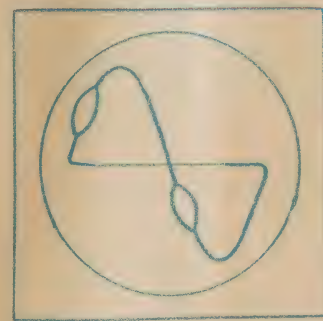
Wave shape is often seen to better advantage if three or more waves are made stationary on the screen.



Hum in the output of an amplifier causes a ripple on the wave peaks and thickening of the sides of the trace.



Under overload conditions, the output wave may be flattened on one or both peaks, or it may assume a very irregular shape.



Instability under operating conditions may be evident as a bulge in the output wave pattern. It may or may not be evident without signal.



The type of pattern you will get when "plotting" input against output. The ellipse indicates phase displacement; while other significant factors are revealed by the length and slope.

waveform visible for purposes of inspection.

Conventionally, the waveform under inspection is applied to the vertical plates, so that it produces vertical deflection of the spot. The time base or comparison signal is there-

fore applied to the horizontal plate.

Leaving aside for the moment the question of time base, some comment is necessary on the application of the signal under test to the vertical plates. As we have seen, a substantial voltage is required to o-

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RAW MATERIALS

Chemical analysis
of materials

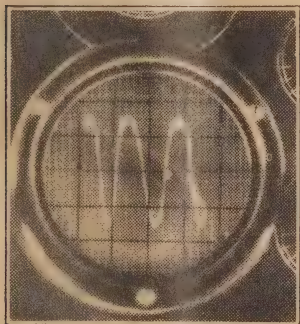
Cleaning tubes
in hydrogen gas

Inspecting
glass under
polarized
light

tain a large trace on the screen, and this may or may not be available. Sufficient signal voltage may be derived from the output of an amplifier for example, but certainly not from any earlier point in the circuit.

For this reason all laboratory oscilloscopes incorporate an amplifier on both sets of plates, so that the instrument can be used to inspect signal voltages of much lower order. Such amplifiers vary widely in respect to their gain and ability to handle a wide range of frequencies. Some oscilloscopes, too, provide for push-pull deflection and incorporate a push-pull amplifier system to ensure the best possible fidelity in the pattern. All this is a matter of complication, cost and specification, and space does not permit here a discussion of amplifier design.

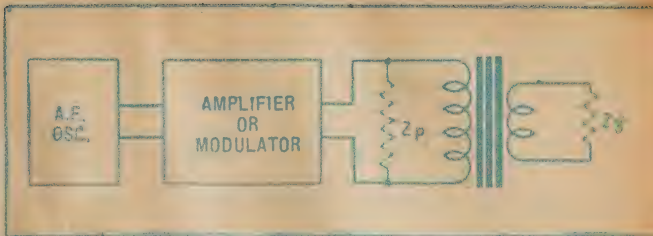
An important point, however, is that the amplifiers conventionally have a gain control on the input circuit which allows the operator to set up a pattern of convenient size almost irrespective of the order of the voltage under test. A typical oscilloscope will give a pattern of reasonable size from any input over about 0.5 volt peak. It is assumed, of course, that this refers to alternating potentials in the audio spectrum and immediately above it, since only a very specialised instrument would incorporate amplifiers capable of handling d-c or radio frequency voltages.



A typical sine wave pattern. The slight compression of the trace on one side is due to non-linearity of the time base at low frequencies.

It is possible to gauge the order of input voltage with an amplifier in use if the operator takes the trouble to plot input volts against gain control setting for a pattern of predetermined height. The accuracy of such calibration will depend on the stability of the control and the amplifier, but calibration is handy, for example, as a guide to the signal level at various points in an amplifier.

Inspection of almost any oscilloscope will reveal input terminals to the vertical amplifier, one of them at earth potential. The output from the vertical amplifier may be brought out to another terminal and bridged across to the appropriate deflector plate. Alternatively, a common input terminal may be employed and switched either to the vertical ampli-



To test power output, the primary or secondary of the output transformer must be loaded by a suitable resistance. Set the output to maximum without obvious distortion, and measure the audio volts across the load.

fier input or directly to the deflector plate.

For general purpose testing it is wise to make up a test prod using a suitably insulated handle and a metal pin. The pin is connected through shielded cable to the "hot" input terminal on the instrument, the outer braiding being connected to the earth terminal. Ordinary shielded wire will do for most purposes, but microphone or light coaxial cable is to be preferred because of its lower capacitance. In use, the case of the oscilloscope is joined to the chassis to the equipment under test, and the prod can then be touched on any point in the circuit, and the resulting vertical trace adjusted to suitable proportions by means of the gain control.

SIGNAL SOURCE

All this, of course, assumes that the equipment under test is handling some sort of signal, as otherwise the only deflection on the screen would be produced by random noise and hum. Before full use can be made of an oscilloscope it is, therefore, essential to have available some steady source of audio signal which can be fed into the equipment under test and inspected as it progresses through the equipment, stage by stage.

The ideal in this respect is some form of audio signal generator such as a BFO or an instrument along the lines of the generator described in the April, 1945, issue of this journal. Such an instrument is capable of producing substantially pure sine waves anywhere in the audio spectrum and indeed, in what is now known as the supersonic region.

OSCILLATOR USE

However, many useful tests can be carried out with a simpler fixed frequency oscillator which will produce a signal somewhere in the range of 400 to 1000 cycles per second. The 50-cycle power mains provide one obvious source of signal, but such a low frequency is not only wearing on any loud speaker which may be connected to the system, but it gives a very unfair picture of the performance of an amplifier or modulator at speech frequencies. It is essential, therefore, that the constructor of an oscilloscope go one step further and build himself an audio oscillator of some description.

The oscilloscope itself can, of course, be used to so adjust the

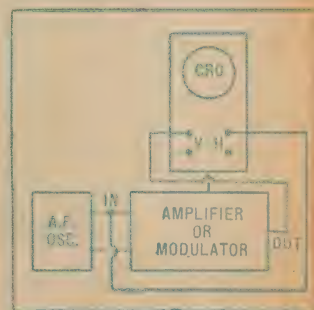
oscillator that it delivers as pure a waveform as possible. For this purpose the output of the oscillator is fed directly to the terminals of the vertical amplifier and the gain adjusted to give a suitable pattern.

For the inspection of waveforms the output from the sweep oscillator—or time base—is switched to the horizontal amplifier, so that the signal is subjected simultaneously to the influence of the time base and the voltage under test.

To obtain a stationary pattern on the screen, it is necessary to manipulate the coarse and then the fine frequency controls until a wave pattern becomes more or less stationary on the screen. It can then be brought to a full stop by switching to "internal synch." and advancing the synchronisation control as far as necessary. It is important to use the control sparingly, as excessive synchronisation voltage can distort the pattern.

In most cases the extremes of single sine wave pattern will be marred by the imperfections of the return trace and a more satisfactory pattern can be obtained by "freezing" three or more complete waves on the screen and confining attention to the centre one.

This general set up represents the most usual one in amplifier work. The internal time base and synchronisation is adjusted for a particular test frequency, and, by means of the test prod, the signal can be traced right through the amplifier from input terminals to load.



Here is the instrument set-up for linearity tests. The CRO is set for "external sweep" and an oblique line or ellipse is produced on the screen.

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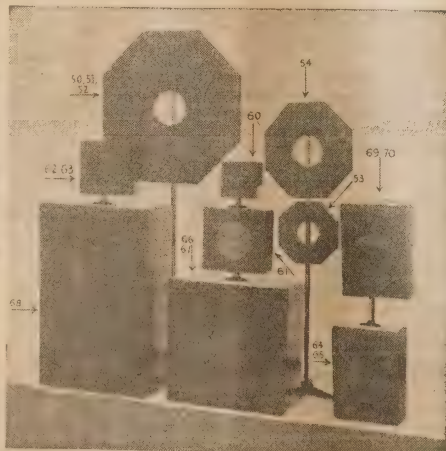
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It is possible by this means to form some idea of the gain over various sections of the amplifier. For example, the gain control on the C.R.O. may be set so that the signal causes only the merest ripple on the trace at a grid circuit, but it may fill the screen entirely at the plate of the same valve. This might represent an obvious gain of 20 times. Ratio of gain in a pentode would be much higher still and, while simple measurements may not be possible, at least it will be obvious from the effect on the screen that larger gain is present. Of course, if the oscilloscope control is calibrated, as mentioned earlier, it would be possible to read off the stage gain directly in decibels.

In making gain observations, it is important to adjust the signal level through the amplifier to somewhere about half power output. Under these conditions the pattern is not likely to become distorted, due to valve overload, nor will it be rendered uncertain by random components of noise and hum.

EFFECT OF HUM

Hum in an amplifier will produce the effect of a multiple trace which is particularly noticeable on the peaks of the pattern. The additional lines may be stationary or may waver rapidly, depending on the relationship of the signal to hum frequency. Hum in the instrument itself will produce the same effect.

Observations on maximum power output are made with the amplifier in the vicinity of overload. You will save yourself and your neighbors a lot of distress if all preliminary overload tests are done with the equipment working into resistive load. This load resistor can be connected across either the primary or the secondary windings of the output transformer, and it must be capable of dissipating the full output of the equipment in watts with a margin of safety.

If the equipment requires a plate load of, say, 10,000 ohms, then a large resistor approximating this value could be connected across the primary winding. The secondary would be left open. Alternatively, the appropriate load may be connected across the secondary, and this may be anything from several thousand ohms down to a few ohms, as for a voice coil winding.

C.R.O. CONNECTIONS

For observations on the primary winding, the case of the CRO would normally be earthed to that of the equipment under test, and the test prod connected to either output plate. Make sure, however, that this connection does not produce instability. A secondary winding under test may or may not have a connection to chassis, but a temporary one can be made, the CRO prod being connected to the other side.

As the gain and output of the amplifier under test are increased, a point will be reached where the pattern departs noticeably from its original form, indicating overload and distortion.



Overload will produce this effect in the linearity trace. Bending at one end generally indicates improper bias conditions.

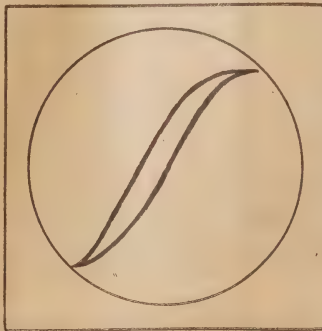
DISTORTION CHECK

If the amplifier is correctly adjusted, the pattern should begin to distort simultaneously at both top and bottom. This would indicate, in the case of a push-pull amplifier, that both output tubes were being driven fully, or, with single amplifier, that it is operating symmetrically about the centre of its characteristic.

Space does not permit a lengthy examination at this stage on differing wave patterns, but, as one becomes accustomed to the oscilloscope, it is possible to recognise different forms of distortion and to take necessary steps to correction. In many cases overload is simply evident as a flattening of the sine wave peaks, due either to grid current in a resistance-coupled amplifier or to the valves running into the severely curved portion of their characteristic.

In other cases, the departure from a pure sine wave can become evident as completely mis-shapen waves, due to a considerable content of harmonic distortion.

For practical purposes, overload can be considered to occur at the point where a wave shape is beginning to deviate perceptibly from its



The type of pattern you can expect when beating a 50 cycle hum voltage against the 50 cycle mains. 100 cycle hum produces a distorted figure "8" pattern.

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correct form. A measurement of RMS signal voltage across the load will then reveal maximum power output of the amplifier under test. For purely speech work, as in an amateur transmitter, a higher degree of distortion can be tolerated and, consequently, higher power output would be realised.

INSTABILITY

It is easy to observe any tendency to instability with or without input signal. A high frequency oscillation will be apparent as initial output or a suspicious thickening of the trace. By turning up the CRO gain and increasing the sweep frequency it is often possible to see the wave pattern of the oscillation. Naturally, further measurements have little significance until this basic instability has been rectified.

In other cases the instability may appear only when the amplifier is delivering power, and it may then appear as a thickening somewhere along the wave pattern. Once again, the equipment cannot be considered to be satisfactory until such periodic oscillation is eliminated.

When overload does occur in an amplifier it is wise to check back stage by stage to ensure that the overload is occurring in the output valves. It is obviously poor economy to provide an ambitious output stage and have the power limited by a voltage amplifier elsewhere in the equipment. However, a certain amount of caution is necessary in making such observations, since overload in the output stage can be reflected as apparent distortion in an earlier point in the amplifier by way of a feed-back network.

OUTPUT PLOT

Another basic method of test involves "plotting" the output of an amplifier against its input on the screen of the CRO tube. For this test the output remains connected to the vertical amplifier, but the input is fed to the horizontal amplifier and the CRO switched to "external sweep."

With no signal input a spot only is evident on the screen. When signal is applied, however, the spot is deflected vertically by the amplifier output and horizontally by the amplifier input. The net result is an ellipse or straight line, whose dimension and angle on the screen can be adjusted by means of the individual gain controls. If there is no phase shift in the amplifier under test, the trace will be a single line, but it is more likely to be a narrow ellipse at most frequencies, resolving into almost a circular pattern at the extremes of the frequency range.

Low distortion in the amplifier means that the input and output signal is similar in characteristic and the "linearity" trace on the screen will be either a straight line or a narrow and substantially regular ellipse. As the gain is increased and the amplifier approaches overload, output and input are no longer similar and the line or ellipse will take

(Continued on Page 89)

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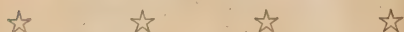
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FROM THE SERVICEMAN WHO TELLS

One of the pastimes of the general public is to criticise those who earn their living by selling their time and talents. Radio servicemen come in for a liberal share of this criticism and, while I do not suggest that it is entirely without justification, I do know that the general public has no appreciation of what running a small business entails.

FOR example I have not infrequently heard people say something along these lines: "He only installed a sixpenny condenser in my set, but charged 7/6 to do it. That's 1400 per cent profit. Daylight robbery... &c."

I wonder whether such folk have ever stopped to work out the reason for such a charge, but let's engage in a little mental arithmetic.

The fact that a serviceman was called in indicates either that the set owner could not fix the receiver himself, or, alternatively, that he was just too lazy to bother about it. Either way, his position and that of thousands of other similar listeners justifies the existence of radio servicemen in the community and, obviously enough, the community owes those servicemen wages and working conditions commensurate with the times. Let's say, for example, that a serviceman wants to clear eight pounds a week and does not want to work more than 40 hours a week, if he can help it.

PROFIT AND LOSS

Now we can proceed to add his income of eight pounds to his other weekly commitments of shop rent, petrol and oil bills, truck registration and maintenance, phone and general shop expenses. You will find that this adds up to something like 15 pounds a week, of which he can only claim eight pounds as his own private income.

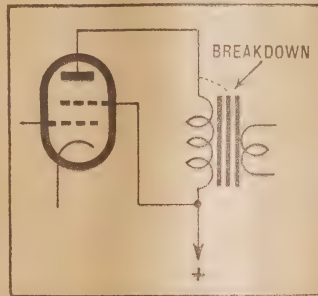
Now, if our serviceman is to take off a few minutes now and again to interview clients and be a generally pleasant fellow, he will be fortunate to average one service job an hour over the whole week, including the time spent picking up and delivering chassis. From these 40 service jobs he has to net about 15 pounds a week income, so that the minimum average charge per receiver works out at about 7/-. There, I suggest, is the basis for the "service charge" which may appear on your docket. It is necessary also to take into consideration the cost of components used to repair the set.

There is, of course, a whole lot more to the economics of running a successful service business, but what I have said will, at least, illustrate to non-professional readers the absolute absurdity of such remarks about "sixpenny condensers." Any full-time serviceman who limits his charge in simple cases to a "coupla bob" is not likely to remain solvent for long.

There is another angle, too, which arises out of my discussion last month

of trouble with an old autodyne superhet. It took up quite a deal of my time to locate and rectify that fault and the cost of service on a strict time rate would have been fairly stiff. Against this, the receiver was of rather ancient pattern and came from a home where money was none too plentiful.

On the other hand, another repair job may involve only a few minutes' work to locate and replace a faulty condenser and, by contrast, the charge may be much smaller in relation to the value of the set and the means of the owner. In such a case



A breakdown between output valve plate and transformer caused some strange effects.

there is a temptation to offset the cost of one job against another, so that the price of the autodyne repair might be reduced at the expense of the other client. Servicemen who advocate this policy point out that there is an element of luck in the speed with which a fault is located. Furthermore, that the receiver in either case was restored to operation, which was the service required.

OFFSET CHARGES

Without taking sides on the matter, one can, nevertheless, make the observation that the scheme of offsetting one charge against another has provided some overseas magazines with the "ammunition" to fire at radio servicemen, among others. If the service charge is made adequate it should be able to absorb some of the effects of delay and ill-fortune in an individual case, as well as covering the normal overhead costs. I guess that that's enough for the time being of the politics of servicing.

By way of a change, let's go through a letter which deals with the problems of another serviceman.

A reader from Cairns takes me to task for not making more frequent mention of "bush" servicemen's problems, but the fact that I operate in a city area is ample explanation of this.

According to this reader, the business of battery-charging has operated more than any other factor to ruin his "once placid" disposition. He says that owners of outlying farms have the habit of running batteries until they will no longer provide radio music, and then putting off the recharging until a particular programme is desired. The serviceman is then expected to bring the battery up to full charge in a few hours.

A 6-VOLT BATTERY

One chap he mentions bought a large 6-volt battery for his vibrator set and was assured of good quality and good service if the battery was not maltreated. Exactly five months later the customer returned the battery with the complaint that it was no good. On examination, the voltage was found to be under 1 volt per cell and the electrolyte well below the tops of the plates. An inquiry as to when the battery was last charged, and by whom, brought forth the reply that the battery had never been charged and that if it was any good it should not need attention more than twice annually. Despite technical explanations, he was firmly convinced that the battery should have been replaced.

The same correspondent goes on: "Some local people buy a new battery, and when it becomes 'flat' they take it to one of the local 'battery boilers' and have it recharged in a few hours. After the violent treatment has about ruined the battery, it is brought to me, and the owner usually expresses disgust that I cannot recharge it to rated capacity in equivalent time. If the battery was bought from me in the first place, I am expected to do something about it in the way of replacement."

"One local 'battery boiler' had trouble with his rheostats, which were overheating. He called me in to have a 'look see.' It turned out that his dynamo had reversed polarity, probably as a result of a back flow of current from the batteries."

"This man took a good deal of convincing that he was discharging his customers' batteries."

So much for batteries and battery-charging. After reading this letter, I felt like offering a prayer of thanks

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Speakers --- 24/-**

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SPRAY GUN**



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PRICE'S RADIO
5 & 6 ANGEL PLACE, SYDNEY.

that the sets in my area all work from the local powerhouse.

As for the remainder of his observations on country servicing I can do no better than quote directly the latter portion of this correspondent's letter.

"Do big orange-colored hornets like music? If not, why is it that fully 50 per cent. of the sets brought to me have large mud nests firmly attached to the speaker cone? Perhaps the idea is to hush the baby hornets to sleep!

ALUMINIUM VITAMINS

"What is the food and/or vitamin value of an aluminium valve-can? I have had several sets in which rats had gnawed the aluminium valve-cans. In one set, fully half of each can had disappeared.

"One fruitful source of my income is the sale of new valves to people who use the full six volts of their car battery on a 2v or 1.5v radio set. I am usually told that the car battery was nearly flat, would not light the car lamps. How could it harm the radio?

"Talking of honesty, the most pleasing compliment I have received to date was from a man who connected his B-battery the wrong way around, and brought the set and batteries in to me. When he returned to pick up the set, he asked, 'What was wrong with the thing?' I said, 'There was nothing at all wrong.'

"How much do I owe you for your trouble?"

"Forget it."

"Well," said the customer, 'you should have charged me for new valves, &c., and I'd have been none the wiser, so here's a quid.'

"That customer advises others to take their work to me.

"Then there is the suspicious customer who wanted me to send to the distributors and get for him a set of dry B batteries. I showed him my stock already on hand, and confessed that they had been in stock for a fortnight. On my refusing to give a discount because of deterioration due to age, the customer walked out. Later, I got a service call from this cunning lad and noted that a set of new batteries had been installed; one 45v block was defective.

"I collected my service fee before I told him what was wrong."

Yes, we all feel like that on occasions, but many thanks, A.H., for your contribution to these columns.

The fact that one happens to have been engaged for many years in radio servicing does not obviate the possibility of being "caught out" technically.

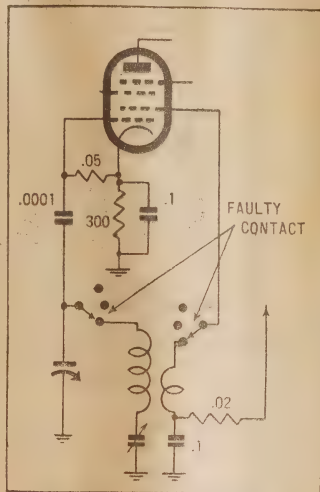
AUDIO OSCILLATION

I had occasion to deal with a receiver recently which exhibited distortion in the form of a buzzing noise on loud volume. The receiver was markedly unstable with anything but a long aerial, while the earth had an obvious effect also. The instability was diminished by turning the tone control to "bass" and last but not least there was a sense of

liveness about the loudspeaker leads.

All these points added up to some form of oscillation at a supersonic or radio frequency, and I was just in the act of connecting up the CRO to verify the point when there was a crack and a splutter from the loudspeaker and the distortion thereafter became very bad. "Ha," I thought, "it really is oscillating now and that should make it a lot easier to find."

It so happened that the earth wire was not connected, and as I went to make a connection there was a flash and an arc of the type any amateur



Faulty contacts can cause much trouble in D.W. receivers.

likes to draw from the plate tank of the final stage. I had seen RF arcs before, but certainly not one off the chassis of an oscillating receiver.

ARC TROUBLE

Anyhow, the CRO was duly connected and it revealed a certain amount of RF oscillation, but not nearly enough to account for the arc which could be drawn off the chassis. Rather puzzled, I placed the multimeter on maximum a-c range between chassis and earth and read off just about 300 volts. What was more strange, it continued to read about the same figure on d-c.

Then the light began to dawn and checking revealed a short between the plate of the output valve and earth. Ultimately, it turned out that the combination of d-c, audio and RF voltage had caused a breakdown on a bad piece of wiring in my Universal speaker, the shield box of which was earthed. The arc was due, of course, to the fact that the chassis was just on 300 volts negative with respect to earth and it is only by pure good fortune that I had not got between them.

The breakdown would probably not have occurred if I had been more careful in the first instance about wiring the test loudspeaker, but the combination of d-c, audio and RF can make it rather tough for both the output valve and transformer.

I nearly forgot to conclude this story by mentioning that the instability was caused by the method of wiring, which brought the plate lead of the output valve close to the input circuit of the audio system. I redirected the lead to obviate this effect and, for good measure, wired a .001 mfd mica condenser between plate and screen of the output valve.

TWIN FAILURE

And now, by way of conclusion, a rather nasty double-barrelled fault. The owner of a big triple-wave receiver complained that the set was rather unreliable in operation and it would only start, at times, after being bumped rather violently.

When I called to inspect the set it was playing quite normally and I found myself hoping very fervently that this was not going to be one of those long time-wasting jobs we experience at times.

Anyhow, on with the job. I turned the cabinet round and speculatively tapped the output valve. The speaker emitted a distinct plop and a further tap put an end to the music. Surely it was not going to be as easy as this! However, there was not the slightest doubt that the output valve was faulty, so I replaced it with a new one and took my leave.

INTERMITTENT

A couple of days later, the set owner reported, rather bitterly, that the receiver was still unsatisfactory and this was certainly not pleasant news to me. I called again at the home, but, this time, no amount of prodding or bumping had the slightest effect on performance.

Rather puzzled, I asked the set owner to refrain from violent bumping of the cabinet and to note whether manipulation of the controls had any effect—if and when the trouble recurred.

About a week later I received a "progress" report that the set was still intermittent, but generally responded to manipulation of the wave change switch. Further, it did not appear to be intermittent when tuned to a short-wave station.

Armed with this knowledge, I duly paid another visit and carefully inspected the whole of the tuning section. Everything appeared to be in order, but, by some careful work with a screw driver, I managed to increase the pressure on the contacts of the switch. I also worked the switch back and forth, holding the contacts to give a scraping action.

As there was nothing else I could do, I put the chassis back in the cabinet and explained to the set owner what measures I had taken.

A telephone call a couple of days ago produced the verdict that the set was now okay. Apparently, there was some foreign matter in the switch, but it is one of those things I will never know. I can only assume that the oscillator was dropping out at odd intervals, but the main point is that the owner is now happy.

Anyhow, the double-barrelled fault cost me three visits and I am keeping my fingers crossed!



The modified guitar and amplifier, which, with a 7-inch speaker, is mounted in a carrying case. An even better one would be obtained from a well baffled 12-inch speaker.

simply been that no practicable battery amplifier has enough power for the job.

Speaking again in general terms, it would appear that the lowest power output which is likely to be of any use is four to five watts, as delivered by a single 6V6-G. Provided the instrument is handled carefully, results from such an amplifier can be satisfactory in a home or small hall.

Unfortunately, the required care is not always shown. In an effort to obtain the most possible output, the performer may turn up the gain too far and a heavily plucked string will send the amplifier into an overload condition, with very unpleasant results.

In the light of this we favor an amplifier with higher power output, even though it will be heavier and more bulky to carry around. If it can be arranged to have a smooth overload characteristic, so much the better.

AN ELECTRICAL GUITAR

In recent months we have had dozens of requests for information on electric guitars. Accordingly, we tell you in this article how to build a pick-up unit and an amplifier which will give a performance equal to expensive commercial jobs. More than that, the amplifier is so designed that it can be used in the home for recorded music or elsewhere as a medium power P.A. system.

THE steel guitar has long been a favorite instrument with entertainers, in any role from Texas to the South Seas. Unfortunately, however, its use in instrumental combinations has been limited by its naturally low acoustic output. Against a background of piano and drums the ordinary guitar is likely to be lost.

Electric amplification has overcome this problem and enabled the volume to be stepped up to any required level without altering the basic character of the sound. Within the space of a few years the electric guitar has progressed from a curiosity to a more or less standard instrument of the lighter sort.

Quite apart from the actual gain in acoustic power, electric amplification makes possible the production of notes and effects which are virtually inaudible without it. By the

correct technique an organ-like quality can be achieved when required.

We do not pretend to be experts on the musical side of the subject, but the electrical aspect is within the legitimate scope of our activities. How you employ the instrument—or whether you employ it at all—is a matter for individual readers.

AMPLIFIER DESIGN

At the outset, a few remarks about amplifier design. The instrument itself gives a moderate acoustic power which, in very broad terms, might be equivalent to an electrical power output of a watt or so. Very obviously, therefore, no advantage is to be gained by connecting an acoustic guitar to any amplifier unless it will deliver a substantially higher power output.

This remark is made because of several recent enquiries relating to the use of amplifiers running off

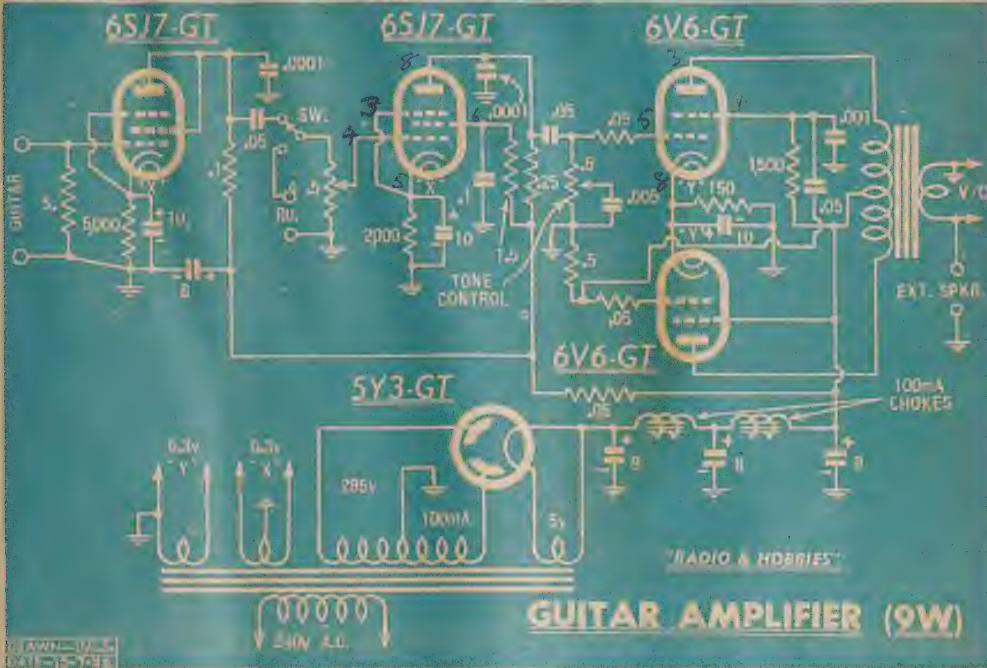
battery supply. Our answer has

The same general remarks apply in regard to the choice of a loud-speaker. It normally has to operate at good volume, and a midget speaker is consequently of little use. A seven or eight-inch speaker would appear to be the smallest practicable size, and the cabinet should be as large as possible to provide reasonable baffling.

In fact, a very good case can be made for a separate large speaker, to be used whenever the performer requires a reserve of power. The difference in output and tonal balance is amazing when a 12in. speaker is connected in parallel with the smaller unit. Obviously, however, a reasonably good baffle will be required for the larger speaker, and this presents something of a transport problem.

Getting back to the matter of electrical pickup, the signal can be obtained from the instrument by any one of three methods:

CIRCUIT DIAGRAM OF THE GUITAR AMPLIFIER



The amplifier circuit has been designed for versatility, adequate output, and suitable frequency response. Essentially it is straightforward, and may be used also with a pickup and microphone.

- (1) A contact microphone.
- (2) Electrostatic pickup.
- (3) Electromagnetic pickup.

As the name implies, a contact microphone is a device which is intended to attach directly to the sounding board of the instrument. It is generally of the crystal type and may attach permanently or by means of a suction cup.

It can be used with any instrument having a sounding board and requires only to be connected to an amplifier having the requisite amount of gain. Any ordinary amplifier meant for microphone work would do, provided the power output is at least four to five watts.

Disadvantages of the contact microphone at the moment are their cost and non-availability and the fact that the results are dependent in part on the acoustic qualities of the instrument.

NO SOUND BOX

Further to this, it may be mentioned that commercial electric guitars have no sound-box at all, the strings being mounted on a metal or polished wooden base which bears only a vague resemblance to the original acoustic instrument. Virtually no sound is heard unless the amplifier is in operation, and a microphone unit obviously has no application in such a case.

Electrostatic pick-up is achieved

by locating metal screws close to the anchor-point of the strings, charging them with a high potential, and connecting to the amplifier through a circuit similar to that required by a condenser microphone.

Although very simple at first glance, this method has very serious disadvantages and is not recommended. The whole circuit is at very high impedance and this, coupled with the high gain required, is likely to produce endless trouble with noise, hum, and instability.

The usual method is by electromagnetic pick-up from the strings.

which, naturally, must be of steel for the system to operate. A magnet pole, carrying a coil of wire, is mounted close underneath the strings, generally an inch or more from the bridge. As the strings vibrate, they vary the lines of force around the magnet pole, induce a current in the associated winding, and the resultant voltage is fed to the amplifier input circuit.

No polarising voltage is required at the instrument, and, once properly completed, the pick-up unit is not likely to need further attention. The impedance of the circuit is low

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1 .005 mfd. mica
2 .0001 mica

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1 0.5 meg.
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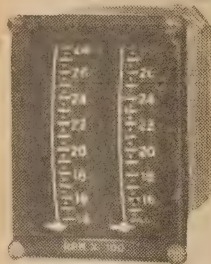
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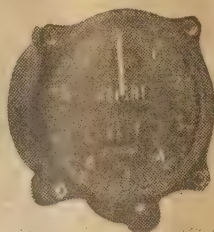
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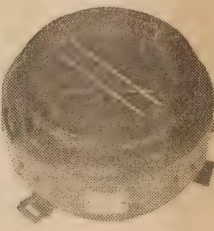
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enough to obviate any real difficulties with hum pick-up, and the output voltage is satisfactory.

Magnetic pick-up units can be made in a variety of ways, and, provided a few elementary rules are followed, there is not much chance of failure. It is, therefore, in order to detail two or three different arrangements, and you can select the one which happens best to fit in with the stock of parts you have on hand.

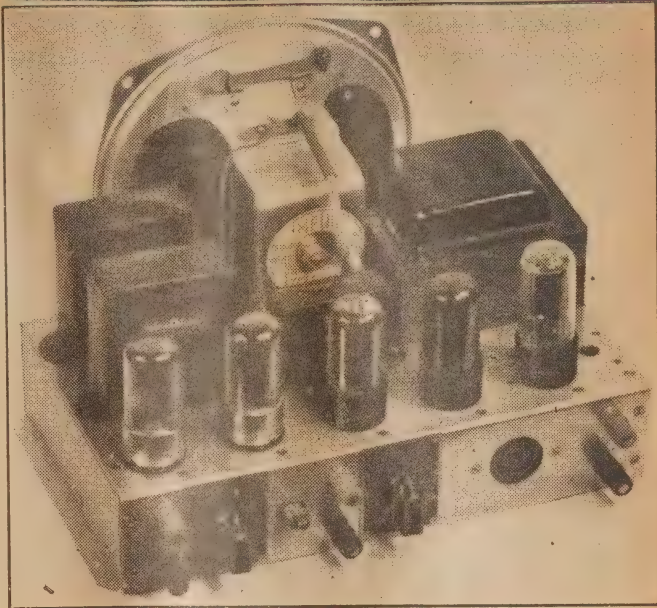
SPACE PROBLEMS

In selecting a particular design, an important consideration is the amount of space it will occupy near the bridge and how much it will disfigure or weaken the sounding-board. These factors must be balanced against electrical performance.

Back in the August, 1941, issue we described a unit which was intended to mount in a non-acoustic-type instrument, where the size of the cut-out was not an important factor.

Two (or four) horseshoe magnets are required, which are mounted in suitable fashion with their like poles adjacent. In this position, of course, the magnets tend to repel one another.

The core "R" for the coil, and the shaped pole-piece should be made of soft iron, but the filler block "Q" may be of steel. Measurements given for the core were 1-8in. x 7-8in. x 2 1/2in., and for the pole-piece 1/4in. x 1/4in. x 3in. The filler block may be of any convenient dimensions, but just high enough to form about a 3-16in. gap between the top of the pole-piece and the underside of the magnets.



This photograph shows all the essential features of the amplifier. The valves are placed in a row in progressive order. The speaker may be mounted as shown, or housed in a more elaborate baffle.

A small gap will ensure high output, but the strings may foul the pole-faces, when plucked, if the gap is made too small. The main bulk of the unit would be sunken below the surface of the sounding-board,

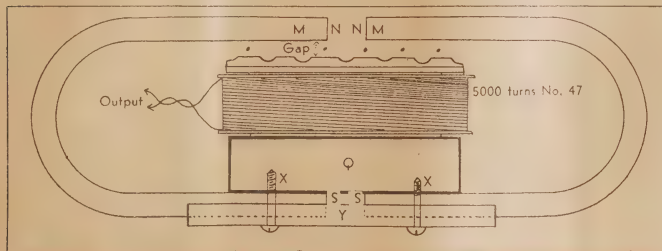
the upper faces of the magnet being finished or disguised in any suitable fashion.

The coil is best wound up on a bobbin made beforehand to fit neatly over the core. Original specifications called for 5000 turns of 47-gauge wire, which could be taken, for example, from a discarded audio transformer. The gauge of wire is not critical in itself, but the output will increase as more turns are fitted on to the bobbin.

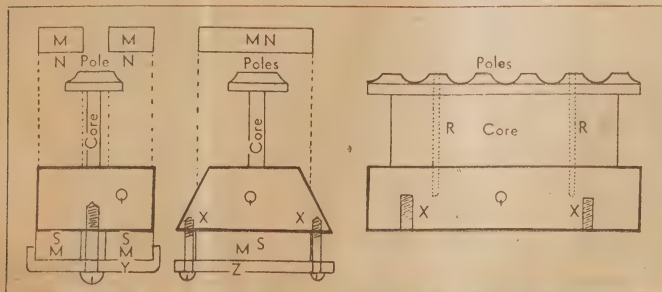
Provided the magnets are in good condition, and that the full number of turns are contained on the coil it is possible to obtain enough output from this type of unit to operate a sensitive two-stage amplifier. In other words, for five watts of output a simple 6J7-6V6 combination would be feasible. For higher power output, push-pull 6V6 valves would be required.

A rather similar unit, but a much more compact one, was featured recently in Radio Craft, and the salient features are also given for the guidance of readers.

The chief requirement is an Alnico bar magnet measuring approximately 3-16in x 5-16in x 2 5-8in, suitably polished on one narrow face. Then make up a coil bobbin, which will fit snugly over the magnet bar allowing the polished face to protrude slightly on one side. Taking care to make a reliable inner connection, the bobbin should now be filled with 32 B&S gauge wire or finer. Finer wire is, of course, more difficult to handle, but will permit substantially more turns and a



Using two or four magnets, a pickup unit can be constructed as above, the strings passing through the gap.



Sectionalised views of the unit drawn above for either two or four magnets.

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As above, but fitted with tube, resistor-capacity network, cable, etc. 37/6 (Post 6d).

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8 x 6 x 5½ new steel grey crackle finish for Vtm's Oscillators, s/generators, etc., 22/6. (Freight extra).

Midget FN Reinartz Coll	6/6
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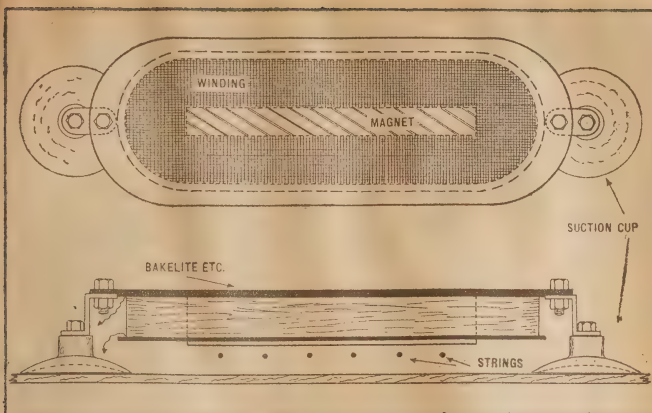
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Another type of pickup unit mentioned in the article.

higher output voltage.

The completed coil and magnet assembly is then glued to a piece of 3-32-inch bakelite, about 5in.-long and with the ends and edges suitably rounded and polished. The assembly is then bracketed to a pair of suction cups, the height being arranged so that the magnet face is just clear of the strings.

OUTPUT

Comments on this unit indicate that the output can be fed into a two-stage amplifier, although this would depend very largely on the strength of the magnet, its proximity to the strings and the number of turns on the winding. If the bar is magnetised longitudinally there is some attenuation of the two middle strings which is something of a disadvantage. However, the unit will have an obvious appeal where amplification is required purely as a temporary measure.

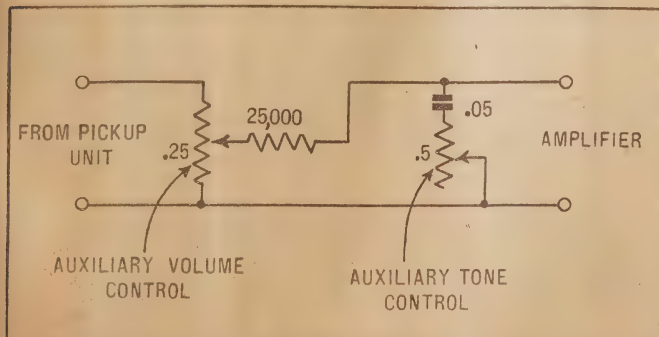
Yet another approach is illustrated by the accompanying photograph of a pickup constructed in our workshop during the past month. As previously stated, the exact details can be varied to meet individual requirements, but the principle works out very well in practice.

The horseshoe magnet was taken from a long-discarded cone loud-speaker, and it is of a type likely to be available to many enthusiasts.

Two angle brackets were made and drilled for attachment to the magnet, which, happily enough, had a hole in each pole tip. Two strips of mild steel, measuring 2in x 3in x 3-32in, were brazed to the angle brackets and the metal dressed so that the plates rested against the magnet tips in exact line and separated by approximately 3-16in.

The pickup coils were salvaged from discarded low-impedance earphones, picked up for a few pence on a radio dealer's oddment counter. These coils were eased carefully off their original cores and six new metal cores were made, measuring approximately 9-16in x 5-32in x 1-16in. These were duly brazed vertically on the magnet face, at approximate 7-16in intervals, corresponding with the position of the guitar strings. Excess metal was then filed away and the earphone coils slipped into place.

The windings are best connected in series, the exact polarity being unimportant. One end of the network is earthed to the magnet and connected also to the braiding of the



Showing how auxiliary volume and tone controls may be attached to the body of the guitar.

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complete with pickup.

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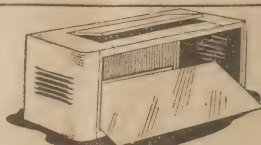
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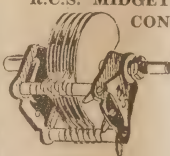
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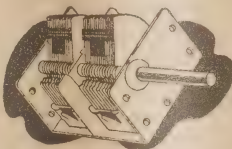


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CV-40 100 mmf	6/6
41 10 mmf	7/3
42 15 mmf	7/10
43 25 mmf	8/4
44 35 mmf	9/-
45 50 mmf	9/6
46 70 mmf	10/6
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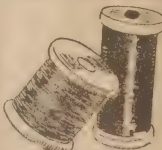
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Metal push-down .. 6d
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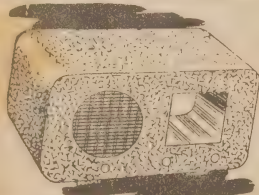


"Q Plus" (1R5)
Oscillator Coll.
As illus. ... 4/9

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Octal Wafer ... 83d.
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Smaller than those shown above. Wrinkle enamel finish, with panels to suit. 11" x 8" x 5 1/2" 28/6
15" x 8" x 7" (lift up lid), 42/6.

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outgoing shielded lead. The other end is the "hot" connection to the inner conductor.

The earphone coils referred to appear to be wound with 500 to 600 turns of 37 B&S or 41 SWG enamelled wire and there is no reason why they should not be made up individually, if the constructor so desires.

Windings from high-impedance phones would have more turns of finer gauge and would consequently give higher output voltage. The exact details are not at all critical, the important point being to see that they are all more or less similar.

TESTING

The unit can actually be tested before installation by holding it over the strings, and you will note immediately the importance of spacing and position the output and tonal balance. It may be desirable in practice to tilt the unit slightly to attenuate the output at the higher frequencies. If, perchance, the output from an individual string is too high, the pole tip can be filed carefully down until proper balance is attained.

Despite the fact that this unit was built with a very old magnet and coils of relatively low impedance, it was found on test that the output was sufficient to drive a high gain two-stage amplifier. However, for certain effects, it is desirable to have a large reserve of gain and to operate the unit with the tone control in the full treble-cut position. Unless this reserve can be attained by use of a high-grade magnet or high-impedance coils, it is wise to have a pre-amplifier stage available.

In practice, permanent installation of this unit would require a slot $2\frac{1}{2}$ in x $\frac{1}{2}$ in cut in the face of the instrument just forward of the bridge. The unit would then be pushed up from underneath to bring the pole tips close to the strings. A hole at each side of the assembly will serve for mounting purposes. If you so desire, a non-magnetic metal plate may be bracketed over the strings by the same two bolts.

It will be necessary to study the construction of the instrument internally so that a mounting position can be clear of internal struts or blocks. The magnet can be mounted at right angles to the face plates, if necessary.

THE AMPLIFIER

The general requirements of a guitar amplifier have emerged from previous discussion, but, to re-state them briefly, they amount to:—

(1) A power output of at least five watts, and more.

(2) Adequate gain. This can be provided by a two-stage amplifier under optimum conditions, but where a reserve is required, a low-gain pre-amplifier stage is desirable.

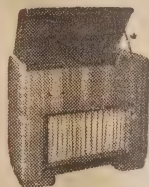
Both requirements are met by some of the circuits described in previous issues, such as the "PA-5" amplifier (June, 1942), the "PA-6" circuit (March, 1944), and "Vib-ravox" (September, 1946). Yet another interesting circuit in this connection would be the "Vox Major"

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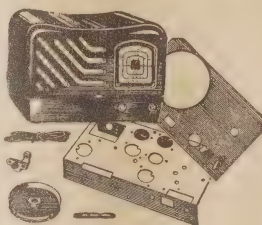
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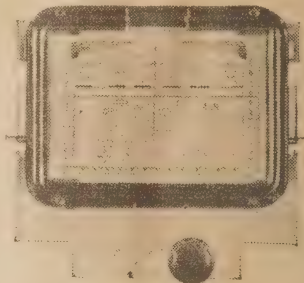
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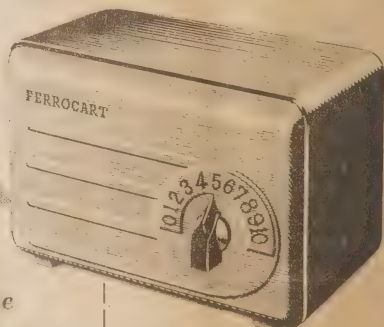
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ET 4435

(April, 1947), with the provision of a low-gain preamplifier stage.

However, the consistent call we have for amplifier circuits and the rather specialised need in this case influenced us to produce a completely new design. In fact, we have taken matters a step further, so that the amplifier can be used to good advantage for recorded music or as a medium power PA system.

The new amplifier is constructed on a chassis measuring 11 x 6½ x 2½ inches, and the layout places all valves along one edge. These are all of the "GT" variety and the effect is very pleasing. The power transformer mounts in one corner of the chassis and the filter chokes in the other, leaving a space between them sufficient for the magnet assembly of a 7in. loudspeaker and its output transformer.

The layout is thus quite systematic and it so distributes the weight that the cabinet carries evenly.

The controls are placed on one edge of the chassis and include terminals for input either to the pre-amplifier or to the second valve. A single volume control serves both channels. The preamplifier would normally be used for microphone and guitar work and the other pair of terminals for pickup or radio input. A tone control is provided, a power outlet plug and, at the other end of the chassis, a pair of terminals for connection to external speaker.

In the normal way the loudspeaker is mounted directly on to the chassis and bears against the front of the cabinet when the chassis is bolted in place. Alternatively, the loudspeaker can be mounted on the face of the cabinet and connected to the chassis by suitable leads.

CABINET

Inside dimensions of the cabinet are 12in. wide by 8½in. deep by 8in. high, and it is provided at the front with an ornamental fret to suit the loudspeaker. When the chassis is fitted into the cabinet the controls and terminals are accessible at the back but, of course, are not visible to the audience.

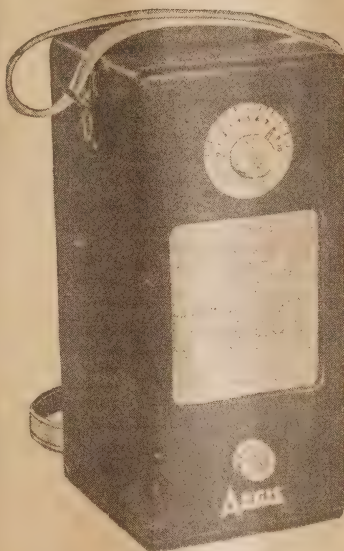
Electrically the circuit is fairly conventional, being essentially a modern version of our well-known "PA-6" amplifier. A pair of 6V6-GT valves are used in the output, the lower valve deriving its signal from the screen circuit of the upper one. This scheme is academically less precise than some other methods, but it is a very simple way of obtaining push-pull operation without loss of gain or the use of an additional valve or transformer. The push-pull connection to the plates allows reasonable efficiency with a small output transformer and ensures low hum level.

The power supply involves a 285 volt 100 milliamp transformer, 5Y3-GT rectifier and a couple of 100 milliamp filter chokes. The use of a low voltage transformer minimises risk of condenser breakdown, so that from this point of view the amplifier should be very reliable.

It will be noted that a "top cut" tone control is connected in the grid



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The AEGIS Personal Portable

To rival in performance and reliability the other AEGIS models is the AEGIS PERSONAL PORTABLE. Weighs only 4½ lbs., and the dimensions are 4" x 4½" x 9". Its simplified design renders construction easy—and the chassis is already drilled for conversion to a 5 valve job. The complete additional Kit includes A.R.T.S. & P. Licence.

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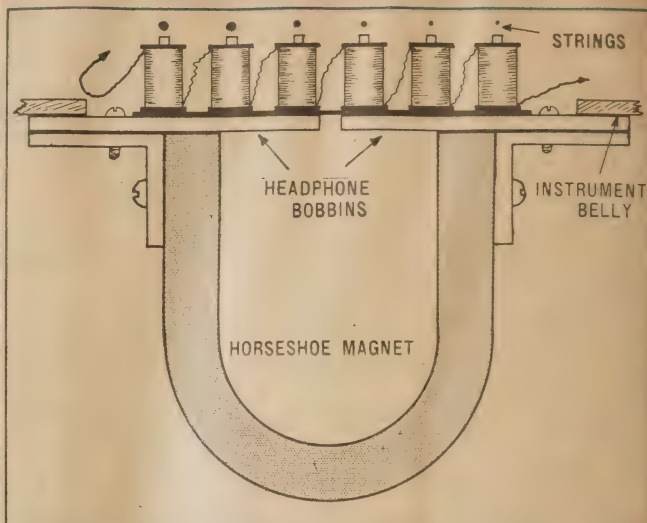
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★★★★★★★★

DETAILS OF THE PICK-UP UNIT



This diagram shows how our pickup head was constructed from a single magnet and separate headphone bobbins attached to brackets and pole pieces.

circuit of one 6V6-GT, but it is effective for both output valves, due to the method of connection. It is rather drastic in its action, but this is in line with the requirements of an electric guitar amplifier.

With the control in the "treble" position the uncompensated tetrodes tend to accentuate the treble and to produce a rather strident tone from the treble strings of the instrument. Adjustment of the control reduces this progressively to the classic "mellow" tone encountered so frequently in radio receivers. In practice, individual items may require the full use of this tonal range.

The first two sockets are occupied by 6SJ7-GT valves, although they could quite well be replaced by the ordinary 6J7-G type. Since there is no negative feedback in the amplifier the gain from the "pickup" terminals is quite high and, in some cases, may be sufficient for the purpose. Because of this, high gain in the first stage is not necessary, and this 6SJ7 is wired as a triode. A valve like the 6J5 would thus serve equally as well in the position.

If you have no idea of using the amplifier for microphone work it could be constructed first without the preamplifier stage and this added only if the additional gain proves to be necessary.

When wiring the preamplifier stage, take the usual precaution of returning all earths to a single point, which can well be the "earthy" input terminal. In the original amplifier there was not the slightest trace of hum, even on a large speaker.

As mentioned earlier, the performance of even a 7in. loudspeaker in a small carrying case is very limited in

the bass region and care has to be exercised to avoid running the amplifier or loudspeaker into an overload condition. It is most helpful, where transport can be arranged, to have a well-baffled 12in. speaker available. This can be connected to the amplifier on special occasions, either exclusively, or in parallel with the smaller speaker. The difference in efficiency and tonal balance is most marked.

AUXILIARY CONTROLS

Current practice in commercial guitars is to have an auxiliary volume control and an auxiliary tone control on the body of the instrument, within easy reach of the player's fingers. In practice the control on the amplifier is then set to give the maximum required volume with the instrument control turned full on. The operating level can then be varied during a performance without a change in body position.

An elaboration of this scheme is to have the auxiliary control operated by a foot treadle so that changes in gain can be made without missing a beat or, over a brief period, as to sustain the output on a particular chord.

All these things are matters for individual decision but, at the outset, the major task will be to provide the basic amplification, leaving the refinements to look after themselves.

Specifications for the chassis and carrying case will be made available, as usual, to the trade, and within a few days of reading this article you should be able to go straight ahead with the construction of this very versatile amplifier.

FERGUSON'S RADIO PTY. LTD.

Featured in this issue is a Vibrator operated Power Supply Unit for the 4 Valve Multi-Talkie Radio Set described in the July issue.

This power supply features a Ferguson Vibrator Transformer type 6V-90/15 and a Choke type C30/25.

6V-90/15 SPECIFICATIONS

Input Voltage.	Input Current	Output Voltage	Output Current
6V	0.5 AMP	100V	15 M. A.

● CHOKE TYPE C30/25 SPECIFICATION

Inductance—30 Henries at 25 M.A. D.C.
10V A.C. 100 C/S D.C. Resistance 1000ohms

● OPTIMUM BUFFER CAPACITANCE

0.008 MFD per Total Secondary Freq. 100 C/S

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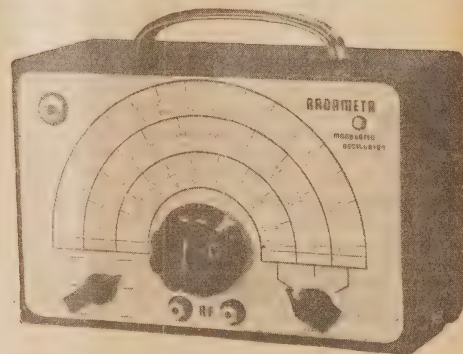
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The amplifier is fitted with a standard 19 inch panel. The meter switch may be centralised for better balance.

A single meter switches from plate to grid circuits, suitable shunts being used to give correct readings.

same at both high and low inputs. In this connection, the best way to scale down voltages and currents for lowered inputs is to reduce them in about the same proportion. At 1000 volts, the 834 is rated at 90 mills. But at 750 volts, this should be reduced to about 70 mills. Under these conditions, the input will be about 105 watts, and your output at 50 mc. may

A FINAL AMPLIFIER FOR U.H.F.

Special valves for U.H.F. work aren't so easy to get these days, at least the very modern types. The amateur transmitter must make his selection from those available, mostly from disposal sources. Recent work with the 834 type has shown it to be still a good valve for the job, despite its comparatively ancient design. Its low price and adaptability for 50 and 144 mc. work make it a good choice.

well be between 60 and 70 watts. That is quite good performance for any valves apart from some of the unobtainable latest types.

At 144 mc. the input figures may well remain the same. The valve is required to reduce ratings to about 90 per cent. or a little less, at 144 mc.

However, at 750 volts for phone work, we have already reduced ratings by 25 per cent. The output will almost certainly be less at 144 than at 50 mc., allowing for the lowered efficiency, but it should still be quite appreciable, and much better than that obtainable from any other triode you are likely to have.

FOR 144mc.

On 50 mc. an 807 will easily drive the valves with enough to spare. At 144 mc. the problem is greater, as the 807 won't do too well at that frequency. A third 834 would be quite a proposition, as also would be an 815 if you are lucky enough to have one. An 832 would be a possibility, but you may be scratching a little to get the output as high as desired. However you will probably find results will be reasonably good with any grid current round about 30 mills. Your plate dissipation will be somewhat higher, with lowered drive, but

MOST transmitting triodes suitable for the abovementioned bands have full ratings only down to 60 mc. Such types include the 809 and its bigger brothers, the 811 and 812. Although even at reduced ratings, these valves will take 100w. in PP quite easily, their efficiency tends to fall at a higher rate than their ratings. In other words, it is better to use a valve which is initially rated lower, but which will hold its efficiency at the higher frequency. Generally speaking, the net output will be better than with the high-rated valves.

834 CHARACTERISTICS

When considering 144 mc. only the 834 is really a proposition at all, as the ratings and efficiency of the other types mentioned are too far down the scale to be of much use. But the 834 will take full ratings to 100 mc. and was used quite widely in Service equipment operating in the vicinity of 144 mc.

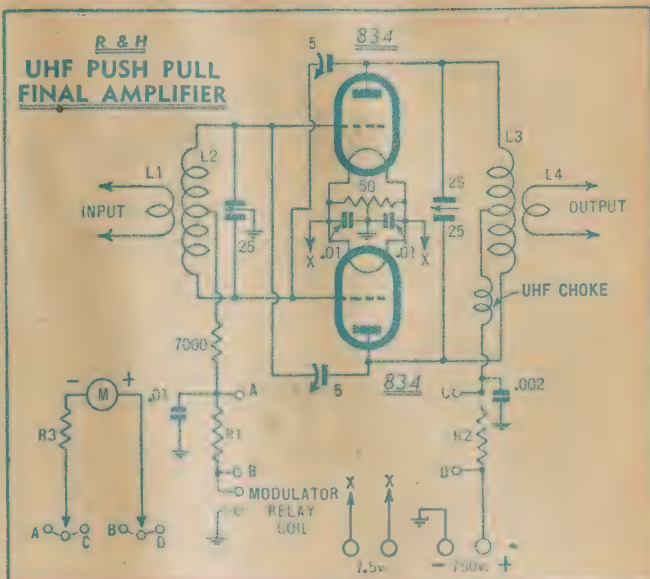
The above assessment was found to hold good in our recent rebuild of equipment to operate on 70 mc. for commercial mobile work.

Another quite vital point is the high losses which begin to assert themselves in this frequency region. Because a valve is rated to operate with 4 watts of drive, this does not mean that the driver must supply only 4 watts. To be on the safe side, another 4 watts will probably be required to allow for coupling losses, added to which the driver should always be capable of supplying more drive than is required for phone work.

LOW DRIVE

The 834 is quite attractive in its low drive demands. Theoretically, 9 watts will be required for two in push-pull. This means that at least 20 watts of drive will be needed to make sure of results. You will probably not be running the valves near their full ratings, but the drive will remain much the

CIRCUIT OF THE P.P. AMPLIFIER



A tapped grid resistor of 10,000 ohms will allow you to adjust the exact bias to suit your drive requirements. R3 is the meter series resistor, R1 and R2 the shunts.

unbalance evidenced by the fact that one valve plate runs a little hotter than the other. This is a fairly good indication of unbalance. If your plates normally run cold, slight detuning of the plate circuit will cause them to show color, and you can check pretty well by this method.

Small unbalances can often be corrected by inserting the grid circuit link to one side of the grid coil rather than at the centre. However, it is far better to work on the layout until your balance is inherently correct. For this reason, a metal panel, if used, must be kept as far from the circuit as possible.

For 50 mc the grid coil has four turns about 1½ in. in diameter, and the plate coil four turns about 2 in. in diameter. The exact spacing will best be determined by experiment, keeping your tuning capacity as low as practicable. You can check on the exact circuit "C" by reference to published charts in various handbooks.

Our amplifier included a change-

over relay for the aerial. If you use 70 ohms co-ax, this is open to criticism, as it may tend to slightly mismatch the line. We used 300 ohm cable, and at this impedance the relay isn't too bad.

A second relay connection is shown, this time to switch the modulator on and off with the final stage. Both these relays operate from the final grid current, and their bobbins should therefore be suitable for operation on 30 to 40 mills. They may both be omitted if unwanted.

METERING

One meter is used to read either grid or plate current through a switch. The best way to work out the shunts is to add series resistance to the meter circuit to bring its total to 1000 ohms. A simple sum in Ohm's law will then allow you to work out the required shunts, which may then be bought as standard wire-wound resistors. Exact values will depend, of course, on the type of meter and its original scale readings.

PARTS LIST

Panel—19 x 10 inches.
Chassis—17 x 8 x 3 inches.
Sub-chassis—4½ x 3½ x 2 inches or to suit your condensers.
Tuning condensers—two of 25mmfds per section, or four single condensers ganged together in pairs. Two neutralising condensers 5mmfds max.
Fixed condensers—3 .01mfds mica, 1 .002 1000v working mica.
Resistors—One C.T. 50ohm resistor, one 7000ohms 10 watt, Meter resistors to suit meter.

Meter—May be 0-1 or 0-5mA full scale.
Terminals for filament and H.T. connections.
Coils—Use wire about 14 gauge bare copper or silvered.
Meter switch—2 x 3 type, leaving centre connection blank.
Sockets—3 4-pin types, one for modulator connection.
Valves—2 834 types.
R.F. choke—U.H.F. type, or 50 turns of 30 gauge wire ½ inch diameter.

there is already something up your sleeve because of the lower input of 100 watts. That plates normally run at a dull red heat.

One reason for the high frequency ratings on the 834 is that the inter-electrode capacities are very low. This means that your neutralising condensers must have a particularly low minimum capacity. We used small 3 plate midgets, and double spaced the plates. Even then, only about 10 degrees of rotation was required for neutralisation.

It seems, therefore, that home-made condensers, using plates about ½ inch diameter, capable of variable spacing, might be as good as anything. These could be mounted on stiff wires, and moved closer or further apart, until the right value is obtained. Or something more elaborate, using a threaded rod and lock-nut mounting, would be even better. Our original neutralising troubles were due to over-neutralising through a high minimum capacity of the condensers, despite their small size.

NEUTRALISING

Actually, the 834 neutralises well, provided the layout is good, and you should be able to achieve perfect balance, at least on 50 mc.

Layout is all-important in an amplifier on these frequencies. The values of inductance and capacity are low, and therefore stray capacities, and the inductance of long leads, become quite serious. You must therefore obtain absolute symmetry in layout. That is why we have included the pictures of our amplifier, as illustrating one way in which it has been achieved.

Because the grid and plate connections are both at the top of the valve envelope, the grid and plate circuits must be above chassis to keep leads short. Lowering the valve sockets by sub-chassis mounting helps here, after cutting holes in the chassis large enough to clear the glass by about ½ in.

Although the leads to and from the grid and plate connections are not as critical as the leads between tuning coils and condensers, they must be kept short and made of exactly equal length. The tuning coils should be mounted right on the tuning condensers themselves, using well-soldered joints to reduce RF resistance. Light copper strip is the best for connecting leads to the valves, although copper braid is also suitable.

FINAL TANK ASSEMBLY

Our final tank assembly was mounted on a small sub-chassis, with the neutralising condensers mounted underneath on the bolts of the feed-through insulators which support the tank circuit. The neutralising leads, again of exactly the same length, cross over and connect to the ends of the grid coil.

If you use ganged midgets, use tubular metal couplers for ganging, and support the condensers preferably at the outside ends. The fact that we have not done this in the grid circuit has introduced a slight



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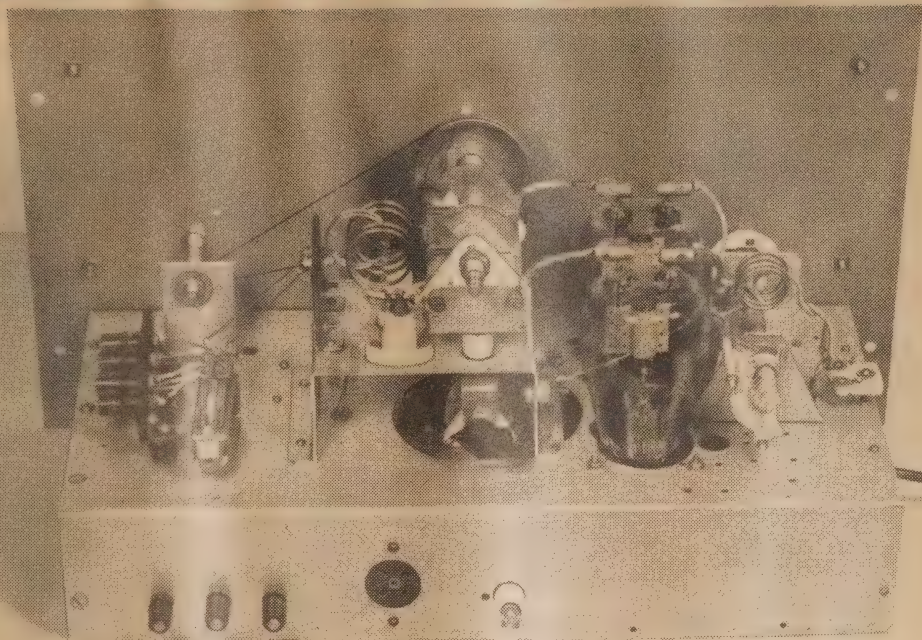
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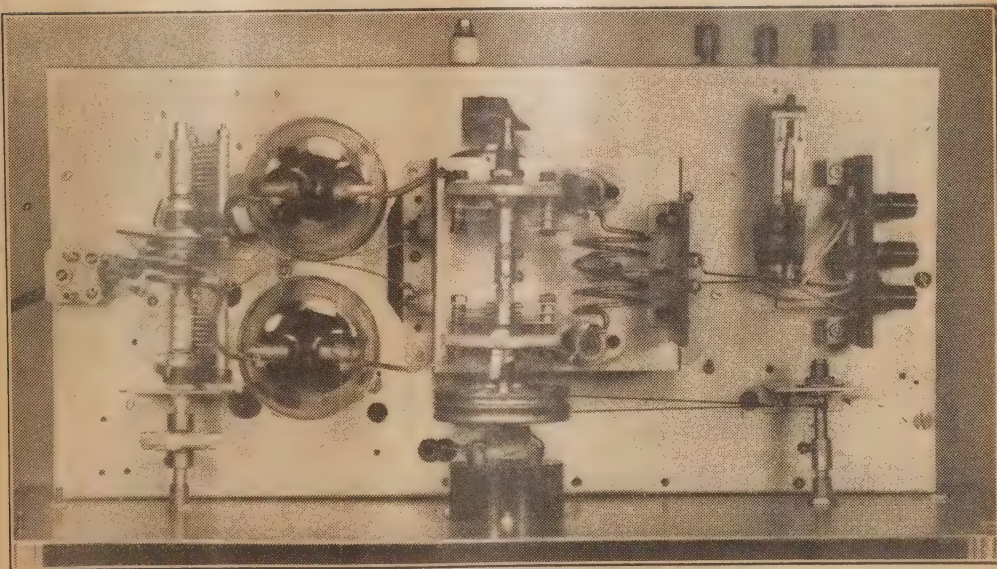
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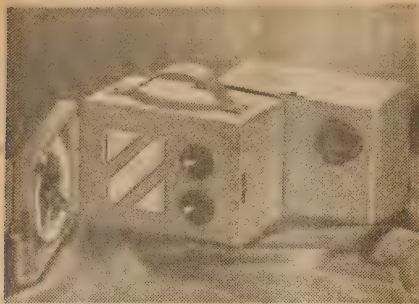
LAYOUT VIEWS OF THE U.H.F. AMPLIFIER



The use made of air-canon mounting for the valves is made clear from this picture. Note the neutralizing condensers mounted beneath the tubes.



This plan view shows the care we have taken to preserve exact symmetry in layout. The drum tuning was used to balance up the controls.



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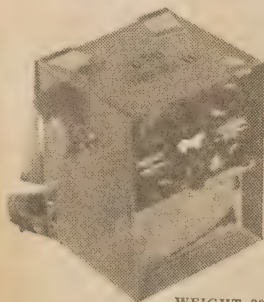
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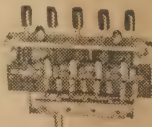
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TRADE REVIEWS AND RELEASES

NEW 4v. MULLARD MANTEL SET

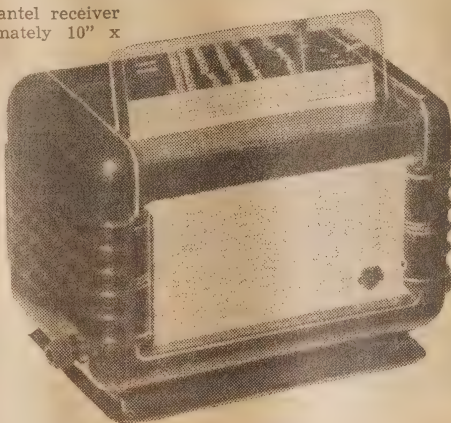
Featuring the novel "eye-line" tuning, model MAS 1000 is the latest release from the Mullard factories. Housed in an attractive moulded bakelite cabinet, this set should have an instant appeal on the Australian market.

THE new Mullard mantel receiver measures approximately 10" x 7" x 6" exclusive of the dial glass. This glass, which is edgelit, carries station calibrations and slips into guide slots in the top face of the cabinet. It is an attractive and unusual arrangement.

The tuning and volume controls are at the sides of the cabinet and the volume control is provided with an "off-on" power switch.

A superhet circuit is employed, the valves being ECH35 converter, EBF35 detector and IF amplifier, 6V6-GT output valve and a 6X5-GT rectifier. The speaker is a 5-inch permagnetic.

List price of the Mullard MAS 1000 is £18/18/-, available through all distributors. The cabinet is available in a range of colors at 10/6 extra



and there is also a slight increase in price in North Queensland.

The set comes packed in a sealed carton, together with an instruction sheet and warranty. Among other things, this sheet gives instructions for fitting the dial glass and, if necessary, replacement of the dial lamp.

RADIOTRON DESIGNERS' HANDBOOK

ADVICE has been received from the Amalgamated Wireless Valve Co. that the preparation is well in hand of the fourth edition of the Radiotron Designers' Handbook. The new edition will be approximately twice the size of its predecessor, consisting of about 750 pages of eight-point type.

Much new material has been added, such as a chapter on mathematics intended to bridge the gap between the ordinary level and that necessary to understand technical articles.

Information on negative feed-back has been extended to fill what appears to be an obvious gap in technical theory. Chapters on radio frequency will cover up to approximately 200 mcs whilst adequate treatment of FM receiver design is also given. As with the third edition, television has had to be excluded because of lack of space, but it is anticipated that the book will meet technical needs for many years to come.

MIDGET VIBRATOR TRANSFORMER

ANTICIPATING a demand for a small vibrator power supply Ferguson's Radio, of 12 McMahons St., Willoughby, NSW, have released a midget vibrator power transformer.

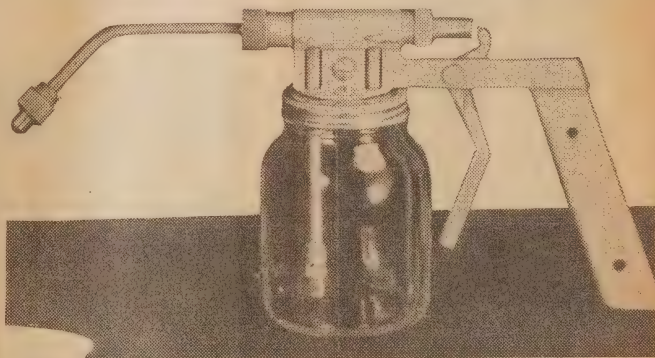
It is similar in size to an ordinary loudspeaker transformer, but is finished in black crackle lacquer. The type number is 6V-90/15. Under maximum load conditions, the transformer will deliver a d-c input to the filter of 100 volts at 15 milliamps.



for an input of 0.5 amp. at 6 volts. This, when using a synchronous vibrator.

Assuming a vibrator operating frequency of 100cs, the recommended buffer capacitance is equivalent to .008 mfd. across the total secondary winding.

HAND-OPERATED SPRAY GUN



Just the thing for the home hobbyist, the "Zefa" all-purpose hand spray has just been released on the Australian market. Manufactured by H. K. Products, Sydney, it can be used with duco lacquer, for stencil work, for cleaning and spraying engines and springs or many other similar purposes. The gun is easily attachable to any ordinary screw-top jar and the nozzle can be rotated to give a variety of work positions. Trade enquiries to A. J. Phillips Agencies, 27 Hunter St., Sydney.

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NEW PRODUCTS FROM KINGSLEY

Latest products from Kingsley Radio Pty. Ltd. include a range of miniature coil brackets and the "Pillo-Fone" extension loud-speaker.

THE coil units are designated as the KU-3 series and individual types are available to suit the popular converter valves. Type KU-35 is for the ECH35, ECH33, EK2 and 6K8-G valves. Type KU-36 will suit the 6A8-G, 1A7-GT, 1C7, and 1R5, while the KU-37 is intended expressly for the single-ended 6SA7-GT. The 6J8-G is best suited by the KU-38 unit.

Of miniature construction, the new units are 3in. long, 2in. wide and 1½in. deep, exclusive of the shaft. Compression type trimmers and core adjustments are readily accessible.

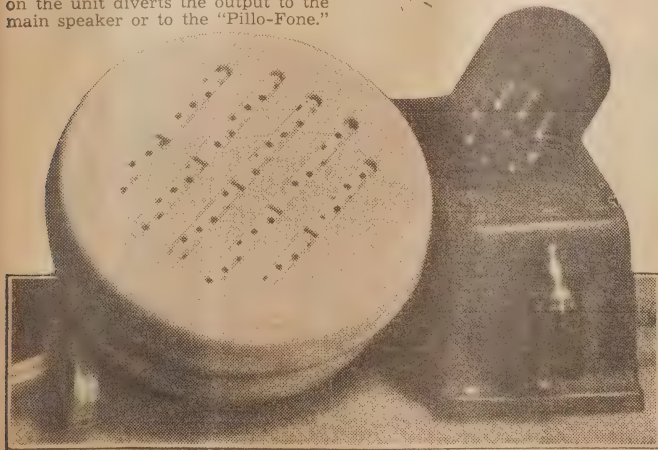
All leads and lugs are clearly color coded for ready connection to the circuit. Broadcast band coverage, with an "H" gang, is from 540-1650 mc., while the shortwave coverage is 5.95-18.5mc., corresponding approximately to 16-50 metres.

The "Pillo-Fone" is a special 3in.



permanent speaker mounted in an off-white moulded case. Plastic leads are brought out for connection to the voice coil circuit of a receiver.

Alternatively, the manufacturers have provided an adaptor box which can be used with any ordinary set using a single output valve of the 6F6, 6V6 type. An adaptor is plugged into the output valve socket, the valve plugs into the adaptor and a switch on the unit diverts the output to the main speaker or to the "Pillo-Fone."



"PALEC" SIGNAL GENERATOR

During recent weeks we have had an opportunity to observe the performance of the "Palec" signal generator under laboratory conditions. The instrument has proved eminently satisfactory and conforms fully to the manufacturer's specifications.



THE Palec generator is a relatively compact instrument, measuring approximately 14in. x 9in. x 9in., and sells at a price which puts it within reach of small manufacturers and the larger service establishments.

There are six frequency bands covering the range from 150kc. to 30mc., the frequency scales being engraved directly on the front panel. Accurate alignment at the factory ensures a high degree of accuracy in this respect. A planetary vernier dial drive is provided.

The internal construction ensures low RF leakage and a routine factory check ensures a leakage substantially less than 0.5 microvolt at 30mc., the figure decreasing with frequency. The attenuator provides continuously variable output at low impedance, and the output can be read directly from the attenuator factor and a two-scale vacuum tube voltmeter.

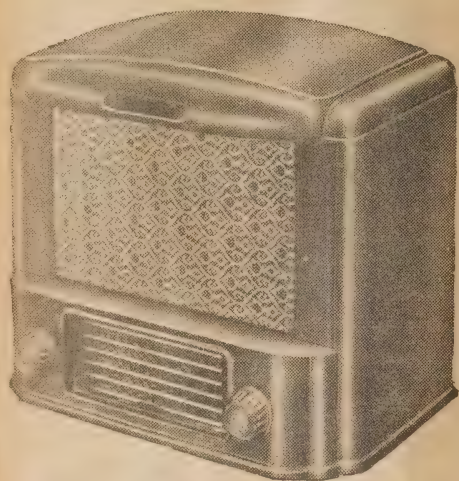
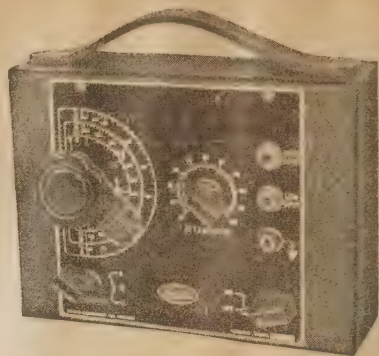
This meter is also used to measure the percentage of modulation, which is variable between zero and 100 per cent. External modulation may be applied to appropriate terminals and the audio modulation characteristic is substantially linear to at least 10kc.

Auxiliary equipment includes a shielded output lead and a dummy antenna.

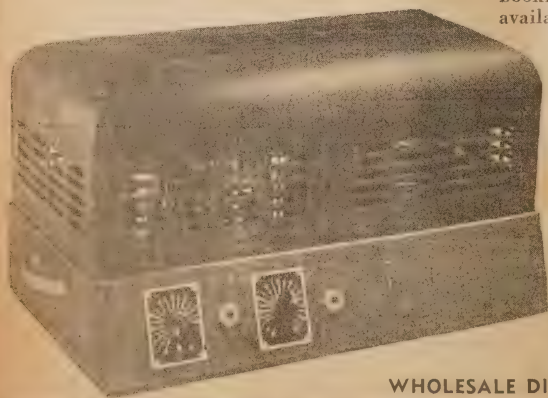
The valve complement includes two 6SN7-GT, a 6AC7 and a 6X5-GT rectifier. One section of the first 6SN7-GT serves as the RF oscillator and its output is fed to the 6AC7, operating as a modulated amplifier. The remaining 6SN7-GT sections serve as the audio oscillator for RF output metering and to measure modulation percentage.

An instruction manual is provided with each instrument, which covers fully the purpose of the controls, the use of the instrument and contains also full details and specifications of the electrical circuit. Manufacturers are the Paton Electrical Company Pty. Ltd., 90 Victoria-street, Ashfield, NSW.

Kit Set Specialists



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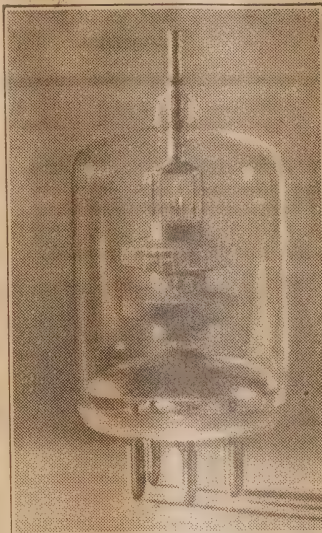
PHILIPS RELEASE V.H.F. TRANSMITTING VALVES

Philips Electrical Industries have released data on two miniature transmitting valves which will be of special interest to design engineers. One is the VHF Triode, type TB 2.5/300 and the other a Tetrode type QB 2.5/250.

THE Triode (TB 2.5/300) is intended for use as either a high frequency or a low frequency amplifier, or as a grounded grid amplifier or oscillator. It has a double-helical thoriated-tungsten filament and operates with natural cooling or forced air, depending on the application.

The valve is of all-glass construction with hard glass envelope and powder-glass base. Its molybdenum terminals fit into a large five-pin socket. Overall length, including pins and top-cap, is approximately $4\frac{1}{2}$ inches, and diameter $2\frac{1}{2}$ inches.

The heater rating is 6.3 volts at 5.4 amps, maximum plate voltage 2500 and maximum plate dissipation 135 watts. At this dissipation the plate, which is of carbon zirconium coated, glows red at a temperature of 850 C. Under maximum conditions at 60 megacycles, the valve delivers a power output of 365 watts in class C telegraphy. Ratings indicate a maximum output of 265 watts at 100 megacycles and 205 watts at 150



megacycles. It is thus of special interest for F.M. and television equipment, mobile service, aircraft control and so on.

The Tetrode, type QB 2.5/250, is very similar in physical appearance, having much the same overall dimensions, the same base and similar electrode structure.

Special treatment of the plate has virtually eliminated secondary emission, with the result that the valve behaves substantially as a pentode. The screen grid is connected to a screen inside the envelope so that, with suitable external circuit arrangement, no neutralisation is necessary below 100 megacycles.

The filament rating of the Tetrode is also 6.3 volts at 5.4 amps, but the maximum anode voltage is 3000. Output under class C telegraphy conditions is 325 watts, but the driving power is only 4.5 watts, as compared with 14 watts with the Triode.

Maximum output at 60 megacycles is 300 watts, and at 100 megacycles, 220 watts.

Details regarding price, availability, and additional data for both tubes are available on application to Philips Electrical Industries, 69-73 Clarence-street, Sydney.

AUGUST SPECIALS

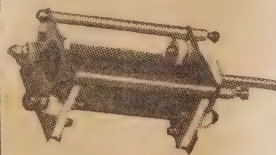


Extension Speakers

5-inch Permag speaker in an attractive black crystallised finished cabinet with chrome fittings. Complete with on/off switch and lead. Ideal for use with Inter-communication systems. Connects in series with the voice coil of your existing speaker.

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Postage 2/6 extra.



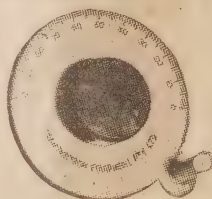
Transmitting Condensers

30 Plate, high grade insulation ball bearing shaft support.

Shaft diameter $\frac{1}{4}$ inch. Length excluding shaft $3\frac{1}{2}$ inch.

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Vernier Dials

Transmitting type, $2\frac{1}{2}$ inches in diameter.

0-100 etched scale.

Positive action friction drive.

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For Amateurs Experimenters and Servicemen

Small parts parcel containing the following:

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6	4 mfd. 525VP	cond.
6	25 mfd. 40VP	cond.
6	.1 mfd. 400VW	cond.
6	.05 mfd. 200VW	cond.
12	.001 mfd. MICA	cond.
12	.00005 mfd. MICA	cond.
6	4-Pin speaker plugs.	
6	5-Pin speaker plugs.	
6	4-Pin Valve sockets.	

All of these parts are new.

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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

HOW TO MAKE YOUR OWN FILAMENT BATTERY

Only a few commonplace materials are required to make a wet battery which, as well as being an interesting experiment, can be put to good use. The nominal output is 1.1 volts, which makes two series cells a proposition for 2-volt valves, provided the current drain is not too high. This month's contributor is Mr. R. Kerr, of Longwood, SA.

A PRIMARY battery suitable for a 1 or 2 valve receiver can be constructed in the ebonite container of a discarded car battery.

For each cell will be required:—
1. 1 piece of sheet copper, of any thickness.

2. 1 piece of sheet zinc.

3. About half a yard of heavy gauge copper wire, with waterproof insulation.

4. A cover cut from an old bakelite or ebonite panel.

5. 2 spring clips from old battery.

6. Some pitch (from cover seals of old battery used).

CONSTRUCTION

The copper sheet should be corrugated, to give increased surface area, and cut to such a size that it fits neatly into the bottom of each cell chamber. The size will depend, of course, on the particular battery case you have chosen. Drill about eight small holes through the sheet and solder a wire firmly to it near one end. The wire should be long enough to reach 2 or 3 inches beyond the top of the case.

The zinc, which forms the other electrode in the battery, will ultimately hang vertically from the cover and diagonally across the cell. It should, therefore, be cut to suitable dimensions and a wire looped through a hole in the centre of one long edge, and soldered. This wire supports the plate and also provides the electrical connection to it.

The cover, which is made from bakelite, needs to be a good fit in the top of the cell, as it has to be supported on ledges which are generally quite narrow.

Drill a small hole at the centre, which should preferably be a tight push-fit for the wire which supports the zinc plate. The wire from the copper plate is brought out in similar fashion, but close to one end of the cell.

Drill a small hole near where each wire emerges to receive a bolt which will clamp the wire and a spring clip. At the other end of the cover drill a small hole for an air vent.

The last hole needed in the cover is for filling with the electrolyte, and it should be provided with a rubber stopper or a waxed cork. Any other odd holes which may be in the bakelite can be stopped either with a screw or with pitch.

ASSEMBLY

Scatter a few crystals of bluestone (copper sulphate) on the bottom of the cell. Place the copper plate in place over these, and spread some more evenly over it.

The zinc can then be fixed in place as described previously. Before working the cover into position, rub some of the softened pitch around the edge of the case, to aid in the adhesion. The two wires leading to the electrodes can be passed through their respective holes and fixed under the terminal clips. The cell can now be sealed by melting pitch around the edge of the cover with a heated knife blade.

FILLING

Place the battery as near as possible to where it will be used, since these cells are of the gravity type, and only the difference in specific gravity prevents the mixing of the two solutions formed by the action of the cell. Use the purest water available, and, in the quota for each cell, dissolve a one-ounce packet of Epsom salts.

The prepared liquid is run in slowly from the bottom, the idea being not to disturb the copper sulphate crystals. A funnel with a cork in the bottom and fitted with a piece of glass tubing is the ideal way to do this.

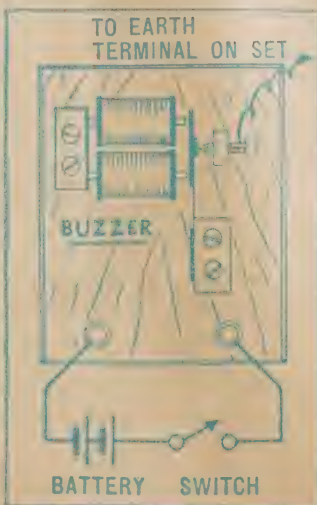
The voltage from each cell is about 1.1, and the supply of current is best when the electrolyte is almost a saturated solution of zinc sulphate. To keep it in this condition, some of the electrolyte can be drawn off at intervals and replaced with water.

"Sig. Generator" For Crystal Sets

JOHN BENNETT of 4 Bishop-st., Oakleigh, Vic., points out that it is sometimes difficult to adjust the cat's-wisker of a crystal receiver and at the same time tune for a station. He suggests that a buzzer be connected as shown in the diagram and used as a signal generator.

The minute sparks that are generated when the contacts make and break cause a very broad radio frequency signal to be radiated. So broad, in fact, that it is possible to adjust the crystal for best sensitivity regardless of the setting of the tuning.

One point to be watched is that the ratio of direct sound from the buzzer to its radio frequency output is best when it is adjusted to give a high pitched buzz. If you attempt to work with a low note, you will probably find that the sound from the phones is drowned by the normal acoustic output. Having adjusted the crystal at your leisure, you can switch the buzzer off and then go ahead to tune the station in the normal way.



TRANSFORMER RANGE by FERGUSON

This list of FERGUSON TRANSFORMERS represents our standard range which we are at present supplying the Radio trade.

This is by no means our complete range when taking into account those Transformers being supplied to manufacturers' special requirements.

Transformers of this type cannot possibly be listed in the space available and manufacturers are requested to contact us direct regarding their special Transformer requirements.

STANDARD RANGE TYPES

OUTPUT TRANSFORMERS

TYPE	PRIMARY	SECONDARY	RATING	TYPE	PRIMARY	SECONDARY	RATING
OP1	5000 and 2500 ohms S.E.	12.5, 8.0 & 2.3 ohms Voice Coil	10W	OP18	3800 ohms P-P	500, 250 and 125 ohms	60W
OP1A	5000 and 2500 ohms S.E.	500 ohm Line	10W	OP19A	5000 ohms P-P	12.5, 8.0, 2.3 ohms Voice Coil	15W
OP2	5000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W	OP19B	5000 ohms P-P	500, 250 and 125 ohms	15W
OP3	6600 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W	OP20	11,800, 8400 ohms P-P (P.A. Range)	500, 250, 166 & 125 ohms	150W
OP4	10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W	OP21	8000 ohms P-P	500/125 ohms	15W
OP5	5000, 6600, 10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W	OP22	3250 ohms S.E. 85 M.A.	2.3 or 500/125 ohms	10W
OP6	5000 ohms P-P	500, 250 and 125 ohms	15W	OP23	3250 ohms S.E. 85 M.A.	12.5 or 8.4/2.1 ohms	10W
OP7	6600 ohms P-P	500, 250 and 125 ohms	15W	OP25	10,000 ohms P-P	Any Two Impedances in 4 to 1 ratio e.g. OP25 500/125.	15W
OP8	10,000 ohms P-P	500, 250 and 125 ohms	15W			OP25 8.4/2.1	
OP9	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	15W			OP25 10/2.5	
OP10	5000 ohms P-P	500, 250 and 125 ohms	25W	OP25M	10,000 ohms P-P	500 ohm Line 10 Tappings	15W
OP11	6600 ohms P-P	500, 250 and 125 ohms	25W	OP15M	6600 ohms P-P	500 ohm Line 10 Tappings	32W
OP12	10,000 ohms P-P	500, 250 and 125 ohms	25W	L1	500 ohms	12.5, 8.0, 2.3 ohms	10W
OP13	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	25W	U1	30,000, 20,000, 14,000	2.3 ohms Voice Coil	10W
OP14	5000 ohms P-P	500, 250 and 125 ohms	32W		10,000, 7000, 5000	2500 ohms P-P-R S.E. Universal Speakers.	
OP15	6600 ohms P-P	500, 250 and 125 ohms	32W				
OP16	10,000 ohms P-P	500, 250 and 125 ohms	32W				
OP17	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	32W				

CLASS B DRIVER AND INTERSTAGE TRANSFORMERS

		Prim to 1 Sec. RATIO					
IP1	Single 6J7G Triode	1	IP3	P.P. Class A. A1 Triodes 45's, 2A3's, etc	Class B P.P. Grids 809, 830B, etc.	2, 3 or 4	
IP2	5 M.A. D.C. Unbalance Single 6V66 Triode	2.5	IP4	S.E. or P.P. Triodes	Class B P.P. Grids 809, 830B, etc.	2, 3 or 2.15	
	40 M.A. D.C. Unbalance 477, etc.						

MODULATION TRANSFORMERS

M25	6000 & 8000 ohms P-P	10,000, 7000, 5000 ohms, 100 M.H.	25W	M50M	Multi Primary	Multi Secondary	50W
M50	3800, 6600, 8000 ohms P-P	10,000, 7500, 6500, 5500, 4500, 3500 ohms 150 M.A.	50W	M125M	Multi Primary	Multi Secondary	125W

VIBRATOR TRANSFORMERS

6V/150	6V at 0.9A D.C.	150V at 25 M.A.	6V/250	6V at 3.4A D.C.	250V at 60 M.A.
6V/200	6V at 2.9A D.C.	200V at 50 M.A.	6V/240/U	6V at 3.9A D.C. or 240V A.C.	250V at 60 M.A. 6.3V at 2A (A.C.). using 6X5GT Non Sync. Operation.

POWER TRANSFORMERS

P30	240V A.C.	150V/150V at 30 M.A. 6.3V at 2A.
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FILTER CHOKES

C30/25	30 Henries at 10V A.C.	100 C/s + 25 M.A. D.C.
C12/200	12 Henries at 10V A.C.	100 C/s + 200 M.A. D.C.

LABORATORY SERVICE TO MANUFACTURERS

The Ferguson Laboratory is continually engaged in research for the improvement and advancement in the transformer and electronic field. This Laboratory together with its technical staff is available to assist manufacturers with their transformer problems.

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Procureable from any wholesale house in all States including Tasmania. If you have any trouble obtaining supplies, write to us direct and we will forward a list of suppliers.

Factory Representative:

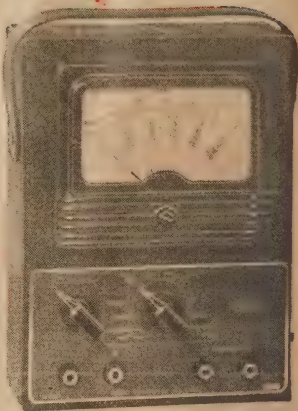
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New...Two more

UNIVERSITY Multimeters!

HOUSED IN ATTRACTIVE
NEW CASES ... AND
MANY NEW FEATURES!



Model MVA/2-AC/DC

Famed throughout the radio electrical industry in Australia, New Zealand and the near East, Model MVA Multi-meter has been supplied in thousands. It has been used extensively in Trade circles, Military organisations and Government Departments. Now it comes to you in a new improved version with a "new look" appearance, and additional features. This new model, MVA/2, really has something. It is a reliable first class instrument—designed for either use on the bench, or as a portable instrument in the field. As with all "University" test equipment, the heart of the instrument is the latest "University" four inch square meter with clear open scale. The following ranges are provided:

D.C. Volts, A.C. Volts, Output Volts	0/10, 0/50, 0/250, 0/1000. The sensitivity of the voltage ranges is 1000 ohms per volt.
D.C. CURRENT	0/1, 0/10, 0/50, 0/250 mA and 0/10 Amps. Ranges are automatically compensated to prevent error due to changes in atmospheric temperature.
Resistance	0/1000, 0/10,000, 0/100,000 ohms and 0/1 megohm. Resistance values as low as .25 ohm can be measured on the low scale. Special circuit retains accuracy, despite voltage changes as battery ages.
Output Ranges	Minus 10 to plus 5db, plus 4 to plus 19db, plus 18 to plus 33db and plus 30 to plus 45db.

Controls and readings are on heavy brass etched panel. Instrument is built into sturdy brocade finished metal case with plastic strap carrying handle. Resistance ranges operate from internal batteries. Price: £11, plus 10 per cent sales tax. Size: 8" x 6" x 3" excluding handle. Complete with test leads and instructions. Range can be extended up to 50 Amperes with "University" plug-in shunts. Leatherette covered carrying case is available separately if so desired.

Model MVD/DC

Pictured above is a new D.C. Multimeter of high quality specially designed for radio service and electrical work. It is a reliable instrument which carries the guarantee of satisfaction in the famous "University" Trade Mark. The following ranges are provided:

D.C. Volts	0/10, 0/50, 0/250, 0/1000. The sensitivity of the voltage ranges is 1000 ohms per volt.
D.C. Current	0/1, 0/10, 0/50, 0/250 mA and 0/10 Amps. Compensated ranges to minimise error due to atmospheric changes.
Resistance	0/1000, 0/10,000, 0/100,000 ohms and 0/1 Megohm. Values as low as .25 ohm can be measured. A special Ohms circuit retains the original accuracy, although the battery may vary due to age.

This special 10 Amperes range is of particular value in the servicing of battery and vibrator receivers. This range can be extended to 25 or 50 amperes with "University" plug-in shunts, which can be purchased at any time. Shunts are also available for lower ranges, such as 2.5 or 5 amperes. No further calibration is necessary when using these popular current shunts. The various ranges of volts, ohms, milliamperes are selected by means of a foolproof switching system, which prevents changes in accuracy due to switch wear and contact resistance of the switches. The meter is the well-known "University" Model R4 rectangular type, fitted with an easy-to-read scale. Controls and ranges are clearly indicated on an etched brass panel. MVD is built into a sturdy brocade finished metal box with plastic strap carrying handle. It is complete with test leads and instruction booklet and has built-in batteries. Price: £8/17/6, plus sales tax 10 per cent. Leatherette carrying case extra if required. Size: As M.V.A./2.

THEY'RE

University

INSTRUMENTS

Manufactured by Radio Equipment Pty. Ltd., 5 North York Street, Sydney. Phones: B3678, B1960.

D I S T R I B U T O R S I N A L L S T A T E S .

NEW CONVAIR LINERS SOON HERE



A fine camera shot of the Convair in flight illustrating distinctive lines.

Now that the Convair-Liner is certificated for scheduled operation, a thorough look at Consolidated Vultee Aircraft Corporation's new transport is in order. Some of its structural components would seem to exceed requirements of the plane's present weight-speed specifications of 39,500lb, 300 mph true air speed cruise at 16,000ft., using 1200 hp per engine.

FRANK FINK, Convair's San Diego Division chief engineer, and **G. G. Green**, chief structural engineer, support this observation. Says Fink: "Intentionally, we engineered the Convair-Liner for a design level flight cruising speed considerably higher than 300 mph true airspeed currently specified.

"The aeroplane's structure will permit us to go up to an indicated level flight speed of 280 miles per hour, or in excess of 360 miles per hour true airspeed at 16,000 feet with a gross weight of 39,500 pounds.

"At the outset we anticipated a succession of gains in available power, as engines improved, and accordingly made ample allowance for growth of the aeroplane in

original stress calculations."

Considering what can be expected of power advances in piston engines having weight comparable to that of the Convair-liner's Pratt and Whitney R 2800 CA-18 power plants, Green feels that the transport will accept, without serious modification, a reciprocating engine delivering up to 3300 horsepower. For this 30 per cent. increase in power, the transport should show a 15 per cent. gain

in cruising speed at altitude, or a true speed of 345 miles per hour.

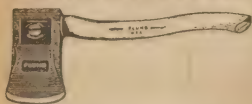
Expressions of these engineers, who have been with the Convair-Liner project since its inception, probably should be viewed as conservative in the light of an even stronger declaration made by William Blees, Convair's vice-president in charge of sales:

"The Convair-Liner was designed to a strength that, without having to rebuild the aeroplane, we can convert it into a jet transport when practical power plants become available."

His estimate is more than a salesman's enthusiasm, for in early development of the Convair-Liner, serious engineering studies were

by
Boris Carone

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AMERICAN PLUMB

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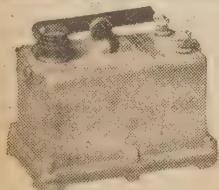
Twin-unit allows complete freedom of both hands. Very sensitive, with connect- FROM ing plug and cable. 7/6

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TELEPHONE PANELS

With 50 mill copper oxide rectifier relay, 3.8v. lamp and socket, 2 phone jacks. A BARGAIN AT 5/-



DYNAMO EXPLODERS

New, contain excellent generator and brass gears. In aluminium Case. Weight 13lb.

29/6 ea., F.O.R.

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A.W.A. FS6 Type. 6 Volt Synchronous Octal Base.

10/- each

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Brand new Hack-Saws, with 6 Blades. Priced at 6/11 each, plus 9d postage and packing.

BRAND NEW

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American made, with 15ft. of Hose.

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AR14 RAAF Radio Sets

New

All Wave using Plug in Coils. Uses two 45 Volt and one 1½ volt dry battery—4 Valves—Types 1P5, 1D8G, 1J6G—

By Purchasing a Reinartz Coil and placing in Aerial Socket in Set all Broadcasting Stations can be brought in—for other bands we can supply Coil Formers 2/6 each.

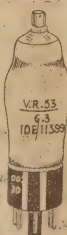
The Set is equipped with 2 Coil Formers but No Valves—Price with 2 Coils £3 F.O.R. The Original AR14 Army Packing Case Hood Metal bound, can be supplied for 3/6 extra.

Sorry NO C.O.D.

EF 39

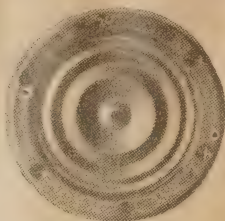
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IN ORIGINAL
CARTONS,

9/6, post 6d.



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2in. diam. 1in. deep. Very sensitive floating diaphragm type, these can also be used as microphones. No Batteries NEEDED.



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Motor Car, Pyrox SPARK PLUG NOISE SUPPRESSORS, 9d each. Post 2½d.

METAL CLAD SUPPRESSOR CONDENSERS for noise elimination in Cars, Motors, and all Electrical interference with mounting lug & wire.

1/- each, post 3d.

BOX ASSORTED RADIO TELEPHONE PARTS useful for Home Construction.

10/-, post free.

DOUBLE BUTTON MICROPHONES plug in to your Radio—with Switch Cord.

7/6 each, post 6d.

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Approximately 15in. long. 5/6, post 1/-.

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MA2351

made of performance and flying costs with (1) more powerful reciprocating engines; (2) two TG-100 propeller-jet power plants; and, (3) two in-board reciprocating engines plus two 19-inch-diameter Westinghouse turbojet engines mounted at the extremity of strengthened outer wing panels.

While the aeroplane presents a configuration that is, at first glance, conventional, a study of the structure reveals originality at many points.

Tie-wing to fuselage, for instance, is distinctive in that in addition to the attachment of the fuselage to the wing through four forgings (connecting to two heavy fuselage frames and receiving wing bolts at junctions with the upper side of front and rear wing spars), the wing is made integral with a strong keel extending fore and aft in the fuselage belly.

THE KEEL

The keel is an extruded 75 ST channel longeron, turned upon its side, and divided into three sections. The mid section is built into the bottom of the wing centre section during wing fabrication.

Extremity sections of the keel, each extending along the fuselage bottom for approximately 80 inches, or a four frame distance, are made secure in their respective positions during fuselage fabrication. In the mating of wing to fuselage, the wing-fuselage keel ends are spliced with stainless steel rivets.

The effect of this additional tie-in of wing to fuselage with a keel member is to increase the effective structural depth of the fuselage by approximately two feet, or 27 per cent.

The result is a worthwhile reduction of fuselage weight.

Allowance of a lighter fuselage structure has permitted avoidance of 75 ST skin on the body and attendant problems of hot dimpling for the use of flush rivets. The fuselage skin is 24 S Alclad, largely .025 gauge and stiffened by the application of light stringers.

The fuselage skin is in sharp contrast with the use of a heavy 75 ST skin for the wing.

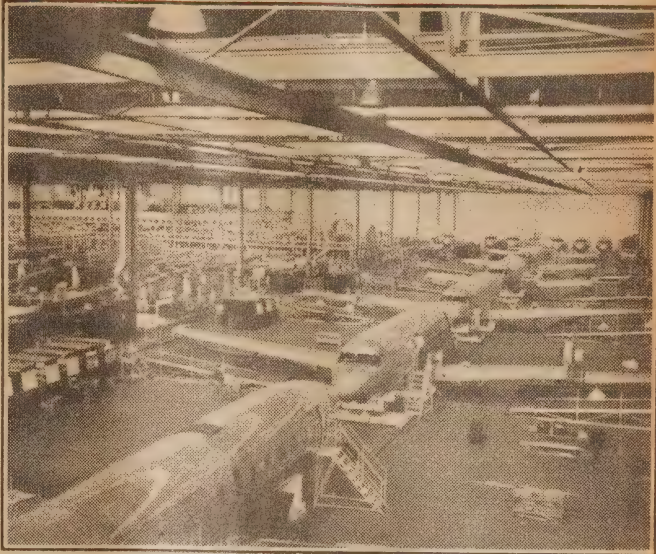
In the Conva-Liner wing, the structure departs from the conventional in that relatively light spars are used and are subjected to shear loads only.

SKIN STRINGERS

Main bending loads are taken by a heavy skin-stringer structure. In area of greatest load between front and rear spars the skin is .081 in top and bottom panels. Thickness of skin beyond areas of principal stress reduces to .051 and .032. While Conva-Liner engineers feel that wing skin thickness is considerably above that dictated by loads to which the present model Liner will be subjected, this feature presents several advantages.

The heavy skin gauge minimises the problem of insuring fuel-tight installation of flush rivets since the

CONVAIRS ON PRODUCTION LINE



Convaairs in production. Upper right shows seven fuselages ready to move from primary to final assembly.

head height of the largest rivet used is substantially less than .081 inches. This relatively greater flexural stiffness of the heavier skin is also a factor in avoiding trouble in the sealing of the integral fuel tanks.

In addition, it ensures torsional stiffness of the wing, and precludes skin bulking and distortion of the wing's aerodynamic characteristics under heavy loads.

Exceptional strengthening of wing skin is gained by attachment, parallel to wing span, of extruded 75 ST "Z" stringers. These are spaced at 5-inch intervals.

In discussing the wing structure, Green said: "We consider that we have been the chief promoters of thick skin gauges, numerous stringers,

and small spar caps as a means of obtaining greatest effective use of materials."

A serious problem was presented in designing the transport for pressurisation and at the same time retaining large door areas desired by various customers.

Distribution of fuselage stresses around the 7-foot high door required by American Airlines for its main passenger entrance, and the longer under-fuselage combination door and stair specified by Western Air Lines called for original thought.

The doors themselves finally were made to do the work of carrying hoop tension loads by the simple expedient of heavy hinge attachment

(Continued on page 79)

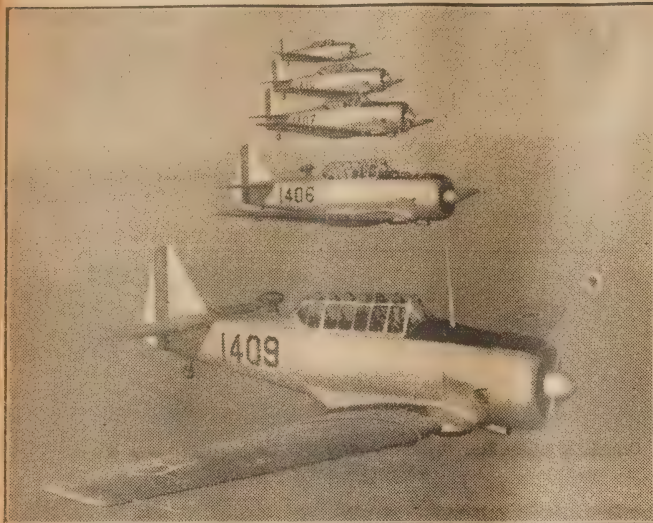
CONVAIR-LINER—COMPARISON OF POWER PLANTS.

(Based on 300-mi. range plus ATA reserve 200mi. plus ½ hr. with 10mi. headwind)

Power Plant.	Two R 2800Ca.	Two 3390C18A	Two R 4360C-12	Two TG-100 Turbines (Propjet)	Two R 2800CA-17 and two wing tip 19-inch Westinghouse jets.
{Take-off Hp.}	2,400	3,200	3,800	2,440	2,400 plus 1600lb. static thrust.
Gross Weight ..	39,000	39,000	39,000	39,000	39,000
Weight, Empty ..	22,840	24,400	28,700	22,200	24,700
Payload ..	11,500	9,630	4,520	98,850	7,550
T.A.S./15,000ft. ..	296	317	345	353(1)	354
One engine out, operating Alt., ft. ..	12,000	16,500	18,000	12,500	22,000
Max. Take-off Alt., ft. ..	4,000	8,000	12,000	4,500	12,000
Direct Costs					
Cents/Mi ..	39.2	41.0	45.8	30.2(2)	49.0
Cents/200 Lb.Mi. ..	.78(3)	.85	2.03	.60(2)	1.30

- 1 Due to turbine continued power output at altitude.
- 2 Based upon use of kerosene.
- 3 Based upon 10,000lb. payload capacity.

PICTURE NEWS OF THE WORLD'S SKYWAYS



Flying formation over California, these North American Aviation AT-6 Texan trainers are ready for delivery to the Brazilian Air Force under the company's arrangement of the re-conditioning of surplus planes for foreign countries. Other nations receiving Texans are China, Argentina, Portugal and Holland, while spare parts are being provided to Venezuela, Chile and the United Kingdom.

Derwent Licence

THE Argentine Government has just released the information that they have concluded a Licence Agreement with the Rolls-Royce for the manufacture of Rolls-Royce "Derwent" gas-turbine engines in Argentina.

The agreement was negotiated on behalf of the Argentine Government by the Instituto Aerotecnico Secretaria de Aeronautica, Cordoba, and was ratified by President Peron. The engines will be manufactured at the Government factory in Cordoba.

This important trade agreement will be of great value to Britain, as well as to Argentina, which is building up its own aircraft industry. By this licence to manufacture the Derwent engine, the Argentine Government will be able to start production with a jet engine which has been thoroughly tested, and which has proved itself to be the most reliable jet power unit in service anywhere in the world. Already, an Argentine jet fighter, the "Pulque" (Arrow), powered by a Rolls-Royce "Derwent" engine, has flown. Furthermore, an Argentine mission is at the Rolls-Royce works at Derby, learning the new technique of manufacturing jet type engines and, in addition, Rolls-Royce engineers are in Argentina to assist with the equipping and tooling up of the

factories which will be employed making the Rolls-Royce "Derwent" engine.

This interchange of personnel will help to develop the friendly relations already existing between Great Britain and Argentina.

* * *

U.S. OK's XP-87

THE US Air Force has placed an order with the Airplane Division of Curtiss-Wright Corporation at Columbus, Ohio, to equip itself for production at the earliest possible date of its latest combat aircraft, the 600 mph XP-87, and has authorised 1,500,000 dollars for tooling and materials and engineering.

The aircraft to be produced is the Curtiss XP-87, an experimental jet-propelled all-weather fighter built at Columbus recently, and now successfully undergoing further testing at Muroc Air Base, California. It is designed for speeds in the 600 mph class.

Although no formal order has been awarded to Curtiss-Wright for quantity production of the aeroplanes, the company has started preliminary work in detailed engineering, tool designing, and planning. Approximately, 200 additional employees for this work will be needed prior to January 1, 1949.

The Columbus plant of Curtiss-Wright was one of the prime sources of military aircraft during the war,

its output having included the production of 5000 SB2C Helldiver dive bombers for the US Navy.

Since the end of the war, it has been a standby plant for the US Navy, and has produced a limited number of scout planes while also developing the XP-87, the CW-32 (a 100,000-pound skytruck for either military or commercial cargo purposes) and carrying on extensive research work on guided missiles and pilotless aircraft.

* * *

Speedy Meteor

A GLOSTER Meteor VII — the world's fastest trainer—has covered the 2550 miles from England to Turkey in a flying time of 4 hours 42 minutes, averaging 542 mph. This striking speed was achieved in spite of the extra drag and weight of three external fuel tanks, fitted to give the extra range necessary. The aeroplane refuelled at Marseilles, Rome and Athens, finishing at Ankara.

In the hands of "Bill" Waterton, Gloster's chief test pilot, the Meteor VII is to give demonstration flights in a tour of Turkey, organised jointly by the Gloster Company and Rolls-Royce, the makers of the aeroplane's two Derwent engines.

The aircraft taking part in this tour is the prototype of the Meteor VII Operational Trainer, and in all major respects is similar to the Meteor IV single-seat fighter. The nose is lengthened to take the extra seat, and dual controls are fitted. Because no military equipment is carried, the trainer is lighter than the fighter and, as a result, it has a faster rate of climb. The top speed is the same, 585 mph.

The Meteor VII belongs to a class of trainer now a necessary requirement in any air force equipped with jet fighters.

* * *

Variable Incidence

FAMOUS for many years as designers of amphibian aircraft, Vickers have embodied their long experience of the land-sea type in the Seagull monoplane, fitted with a Griffon engine, driving two contra-rotating propellers.

Chief feature of interest, however, is the very ingenious wing. It can be pivoted at its roots to adjust its angle of attack; that is, it can be "tipped-up" to give a quick take-off or slow landing, and returned to its normal position for cruising or high-speed flight. For stowing the Seagull in the limited hangar space aboard a carrier, a power-operated wing-folding system is fitted.

These features, together with its good performance and amphibious accomplishments, make the Seagull an attractive aircraft for spotting, training, air-sea rescue, and many other duties.

Hastings Is Fast

THE fast "Bristol" Hercules-powered four-engined Handley Page Hastings, at present touring Australasia, has flown the 1340 miles from Sydney to Wellington in 4½ hours, and at an average speed of 282 mph. (Time taken by the average airliner operating over the route is 6½ hours.)

Major R. E. Nicoll, Handley Page sales manager, who is one of the party on board the aircraft, reports that Australians and New Zealanders are showing "very real interest" in this, the fastest and largest British military transport now in production for the RAF. From governmental and aeronautical circles in the Dominions, there is, Mr. Nicoll adds, an attitude of comradeship and helpfulness.

Among New Zealanders to fly in the Hastings were the Mayor and civic officials of the New Zealand town of Hastings. They circled above the namesake town and, over its centre, received from Handley Page's chief test pilot (Squadron-Leader H. G. Hazelden), a letter of cordial greetings and good wishes from the Mayor of Hastings, in Sussex.

★ ★ ★

Athena Uses Turbine

THE increasing tempo of Great Britain's propeller-gas-turbine development programme is emphasised by the Avro Company's announcement that their Athena I military

The North American P-82 "Twin Mustang" fighters are "backing up" in supply line to the United States Air Force due to engine difficulties. Dozens of the craft, seen at right, remain unaccepted due to valve trouble in the Allison V-1710 engines. Procured for long range escort purposes, the double fuselage craft are the only fighter types now in production capable of providing bomber escort for distances over 1000 miles.

trainer, powered by an Armstrong Siddeley Mamba turbo-prop engine, made a successful first flight recently. This follows the recent initial flight of the Boulton Paul Balliol, an aeroplane in the same class, and also fitted with a Mamba.

Jim Orrell, Avro's chief test pilot, took the Athena up to 5000 feet during the flight, which lasted 20 minutes. Afterwards, he said that aeroplane and engine "behaved very well."

The Athena conforms to an RAF specification for a three-seat advanced trainer, suitable for training pilots in "all-weather" flying, as well as being adaptable for instruction in bombing, gunnery, photography, and glider towing. It is of orthodox low-wing layout, with a retractable tail-wheel undercarriage, and has the pleasant, well-balanced appearance common to the unbroken line of Avro trainers dating back to the 504K biplane of the First World War. Top speed of the Athena I is 287 mph, cruising speed is 253 mph. Together

with the Merlin-engined Athena II, it will be on view at the SBAC flying display and exhibition, to be held at Farnborough.

The Mamba's small diameter—only 27½ in.—and the absence of exhaust pipes and projecting air intakes, has resulted in a slim, cleanly-cowled nose. Most of the 1100 hp developed by the Mamba is used to turn a three-blade propeller, but a jet pipe from the rear of the engine is taken under the cockpit floor, to emerge at the right-hand side of the fuselage, just behind the wing root. The jet from here gives additional thrust.

Less than two years after the Mamba made its first test-bench run, it completed its full 150 hours Air Ministry type-test run, and became the first engine in its category to pass this test.

★ ★ ★

Whittle's Record

GREAT Britain has just rewarded a man whose name will always be as closely associated with gas-turbine aero engines as the name of

development of the super-charged piston engine, directed his efforts to the centrifugal system of compression. This opened a quicker way to success than the axial-flow, and was responsible for the fact that Great Britain was able, as long ago as 1945, to gain a strong lead in the development of the gas-turbine—the aero engine of the future.

★ ★ ★

Supersonic Power

THE power plant of America's first supersonic plane is a simple four cylinder rocket motor without moving parts.

Located in the tail of the plane, the motor delivers a thrust of 6000 pounds which, at the speed of sound, would be equivalent to approximately 12,000 horsepower.

The four cylinders are mounted in diamond shape. They can be fired in any combination. Each gives 1500 pounds of thrust.

Fuel burned in the combustion chambers is liquid oxygen and alcohol forced in by gaseous nitrogen.



Parsons is with that of the steam turbine.

This man, Air Commodore Frank Whittle—already honored by prominent British and American engineering societies—has been granted the sum of £100,000 for his pioneering work in the field of jet propulsion.

It was he who, with the support and encouragement of a few friends, established in Great Britain the principles which later provided the basis for such famous engines as the Derwent, Nene, Goblin, Ghost, Mamba, Python, and Theseus, and for a number of well-known American gas-turbines.

Abroad, research into the problems of the gas-turbine had led designers to favor the axial-flow type of compressor. Whittle, profiting to some extent by the wide knowledge and experience gained as a result of the de-

The nitrogen is contained in 11 tanks mounted in the nose, behind the pilot, in the landing gear compartment and aft.

Pressure applied to the tanks causes the nitrogen to force the fuel into the burners.

The entire product of combustion is the thrust which shoves the plane forward. There are no turbines or other parts to use any of the thrust as in the case of a jet engine.

Since the rocket ship carries its own oxygen, there is almost no limit to the altitude obtainable as far as the power plant is concerned.

On the other hand, since it carries its own oxygen instead of taking it from the outside air, its flight duration is severely limited. For instance, the present supersonic flier, the XS-1, will stay up under full power only 2½ minutes.

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PT. 32.

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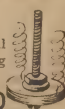
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SARO SR/45 BRITISH LUXURY BOAT

DESIGNED to meet the requirements of the most exacting routes in the world, the giant flying-boats will have the range and speed to operate a direct London-New York service against unabating headwinds of up to 90 miles an hour.

Designated the Saro SR/45, the new flying-boat was accepted by the British Ministry of Supply, and construction was sanctioned in May, 1946. The sketch here is based on models and on details made public by the designers.

The Saro has extremely clean lines." The hull is of figure 8 section. The aircraft is a high-wing monoplane, with a two-step hull swooping up to a tall single fin and rudder and a tailplane with marked dihedral.

Operational flexibility is a feature of the new flying-boat. It will be suitable for medium, long and extreme stage services in any part of the world. For short trips the Saro will be able to carry 140 passengers.

The three flying-boats now under construction will have seating for 150 only, however. In this form, the aircraft will have a maximum range of 5500 miles.

Excellent performance is anticipated. The wing is of the thin, low-drag section, with completely retractable wing-tip floats. Great engine power and a low-drag keel combined with the generally clean design make for high speed.

TWO DECKS

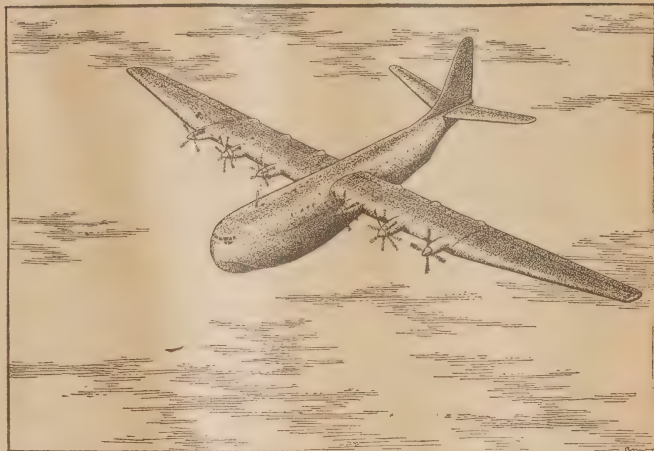
Deck construction is in three layers—the planing bottom, lower deck and upper deck. The two decks are connected by stairs at each end. The interior gives an impression of great spaciousness, according to reports from those who have inspected the full-scale wooden mock-up of the aircraft.

Sixteen watertight compartments are provided in the keel as a precaution to lessen the risk, should a forced landing occur in heavy seas, to assist in giving maximum buoyancy, the SR/45 also has a watertight outer wing section and great strength in the hull.

Power will be provided by 10 Bristol Proteus airscrew-turbines mounted in four coupled pairs, with two single outboard units. Air inlets for the turbines will be located each side of the six-engine nacelles. Exhaust nozzles, in the trailing edge of the wing, will contribute added power.

Each pair of coupled Proteus propeller motors will jointly power a two-stage reduction gear which will drive contra-rotating airscrews. The outboard units will each drive a single blade-bank propeller.

The Saro is to operate at 30,000



Three "super" flying-boats are under construction at Cowes, Isle of Wight (England), by the Saunders-Roe Company. The first of the trio is expected to be ready for testing at the end of the year.

to 40,000 feet. Designers believe the aircraft will have a speed exceeding 350 miles an hour.

The hull will be pressurised, so that no discomfort will be suffered by passengers at great altitude. The internal pressure will be maintained at the 8000ft level pressure.

Literally a "Queen Elizabeth of the Air," the Saro will be able to

cater for luxury air travel, and it is contemplated that round-the-world cruises will be possible in less than one week's flying time.

Some of the basic details of the Saro's dimensions have been revealed. Wingspan of the aircraft will be 219ft, length 146ft, and height to top of fin 55ft. 9in.

Gross weight is given as 135 tons.

CONVAIR SOON FOR AUSTRALIA

(Continued from Page 75)

to a 75 ST longeron at the top of the door cutout area, and at the bottom by securing the door to the fuselage with strong hook latches. This applies to the American Airlines door, which swings outward and up from a top hinge point. In the Western model the door is secured along its length by hook latches which transmit hoop loads through the door structure.

Considerable interest has been expressed concerning the apparent small size of the Convair-Liner's landing gear.

Compared with landing gears on other aircraft it may be cited as an assembly of relatively short structural members and small wheels. However, specifications of the transport show that despite its short-legged gear, propeller ground clearance is adequate; 12 inches in the case of models using the 13 foot one inch Hamilton Standard propeller.

Extreme interest attends attachment of the landing gear to the wing. Fittings are such that, theoretic-

ally, in a crash landing, the main gear will be wiped clear of the aeroplane without destruction of wing spars or rupture of integral fuel tanks.

Since the inboard bulkhead of the integral tank terminates at the engine nacelle area, conventional engineering practice would have dictated the use of this strong, rigid member as a mounting panel for landing gear attachment fittings.

However, Convair engineers elected to attach to the unencumbered spars, inboard from the tank wall, fittings that extend downward to provide landing gear attachment points considerably below the under-wing surface line.

Although no destruction tests have been conducted to prove out the theory of a wipe-off of landing gear in a crash, engineers feel that the design can be considered a true safety feature.

The table included in this article, not previously published, shows possible conversion of the Convair-Liner (Convair 240) as a jet transport.

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P.M.G. MORSE KEY **10/- ea.**
(Without Headphones).

P.M.G. MORSE KEY. With brand new Stromberg-Carlson headphones **19/6**
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Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes. **39/6 ea.**

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No. 1 Diam. 3 5-8 Foc. Len. 10in.
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BEST QUALITY SPANNERS

1 Steel 1 1/2 x 3-16 Whit. Spanner, 1 steel 1 1/2 x 5-16 Whit. Spanner, 1 Van chrome 1 1/2 x 5-16 Whit. Spanner, 1 steel 1 1/2 x 7-16 Whit. Spanner, 1 steel 1 1/2 x 9-16 SAE Spanner, 1 Van chrome 7-16 x 1 1/2 SAE Spanner, 1 Van Chrome 1 1-16 x 31-32 SAE Spanner, 1 steel 13-32 x 5-16 SAE Spanner, 1 steel 19-32 x 13-32 SAE Spanner, 1 steel 25-32 x 1 1/2 SAE Spanner, 1 steel 15-16 x 1 in. SAE Spanner, 1 steel Spanner 1 1/2 x 2 SAE, 1 steel Spanner 1 1-16 x 3/8 SAE, 1 steel Spanner 1 1/2 x 1/2 SAE, 1 Ring and Open End Spanner 7-16 SAE, 1 Ring and Open End Spanner 1/2 SAE, 1 Ring and Open End Spanner 1/2 SAE, 1 Magneto Spanner 1/2 x 7-32, 1 magneto Spanner 2BA x 4BA, 1 Ball Pein Hammer, 1 1/2 lb., 1 Metal Tool Box, 3 1/2 x 7" deep x 15" long.

The Lot for £4.

Free on Rail Sydney.

Please state your nearest attended Railway Station.



Genuine P.M.G.

Morse Key with Light

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With Carrying strap.

Our Price 5/6 ea.

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EXTRA SPECIAL WET WEATHER OFFER

Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester; 1 pair brand new waterproof Gauntlets.

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CLAW HAMMERS

Ex-Army, BRAND NEW. 24oz. each **5/11**

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BLACK OILSKIN SOU'WESTERS

Ex-Navy, Brand New, original price 8/6. These are super quality. Out they go.

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BRAND NEW, ALL SIZES. For warmth and hard wear these coats are unexcelled. Worth at least £5.

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4 1/2 lb. KEENCUT AXES

Complete with handle.

Brand new. **PRICE 18/6**

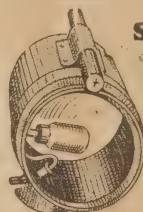
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GREASE GUN



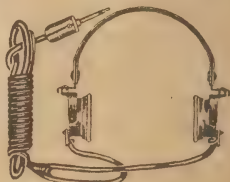
ZERO PUSH-TYPE GREASE GUNS, EX-ARMY.

3oz. slightly used, perfect order, 9/6 each; 10oz., slightly used, perfect order, 15/- each. Postage 1/6 extra.



Spot light

Ideal for fishing, hunting, shooting, Bragg new. Original cost £2/15/- each. Our Price **17/6** or together with Morse Key, Light and Case, 23/- Complete with Stand. Freight 3/-.



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Brand new, S.T.C. and Stromberg-Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure — 130 ohms impedance **9/6**

Postage, 1/6 extra.

2000 ohms impedance **£1**

Suitable for crystal sets.

PLEASE NOTE: These 'phones are brand new, ex-Army, and not military rejects.

STIRRUP PUMPS

Brand new American Stirrup Pumps, original cost 27/6. These are in perfect condition.

Out they go, each **5/6**

Complete with 15ft. of hose.

Interstate, 3/6.

Postage, NSW, 2/-.



No C.O.D.

DEITCH BROS.

Please note our new address
70 OXFORD ST., SYDNEY

HEATER FOR THOSE POWER FAILURES

NEW USE FOR THE PRIMUS STOVE

Here is a simple idea which will enable you to keep warm despite power rationing and other failures of normal facilities. And of course, there will be many other cases in which it can be used when other heating methods are impracticable or not available.

The portable radiator described here consists of a simple and easily-made heating unit and parabolic reflector attached by suitable means to an ordinary paraffin pressure stove or primus.

During the cold weather, such a radiator is invaluable, as it provides a very convenient and inexpensive means of heating, and is, of course, ideal for the bathroom, where the absence of steam and general damp-

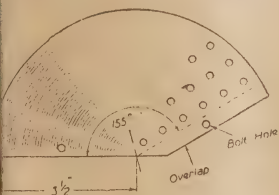


Fig. 1—Shape and dimensions of heating cone blank.

ness prohibits the use of any portable means of electrical heating.

The dimensions given for the various components are a generalisation, although suitable for the average pressure stove, they may have to be slightly varied to suit individual circumstances.

HEATING CONE AND REFLECTOR

The heating cone is made from a piece of stout tinplate, 7 1/2 in. by 3 1/2 in., shaped as shown in Fig. 1. A series of 1/4 in. diameter holes is drilled in the tinplate, which is then carefully shaped to form a cone. The measurements of the cone, allowing a 1/2 in. overlap for joining purposes,

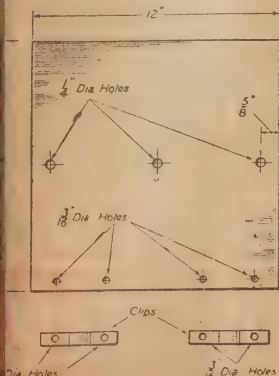


Fig. 2—The reflector plate drilled for the fitting of heating cone and flame guard, and also showing fixing clips.

should be 3 in. diameter by 3 1/2 in. long. The overlap is drawn together and secured by two or three small nuts and bolts.

The reflector is made from a piece of 16 or 18 gauge aluminium 12 in. square. A 1 in. diameter hole is drilled in the exact centre of the reflector to take the heating cone, and two more holes of the same dimensions are made within 1/4 in. distance from the two sides for the flame-guard supports. A further four 3/16 in. holes are suitably drilled along the bottom edge to bolt on the clips which secure the reflector assembly to the stove. (See Fig. 2.) When the holes are drilled, remove any cross that may be present around same, and well burnish one side of the aluminium sheet with

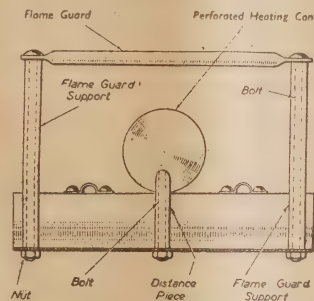


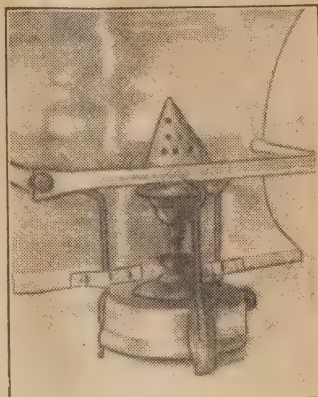
Fig. 4—Plan of radiator showing assembly layout.

a good quality metal polish. The reflective powers of the radiator depend absolutely upon the quality of the finish imparted, so every care should be taken to ensure a perfect mirror finish.

The aluminium sheet must now be carefully bent into the concave shape as indicated, and the heating cone fixed in position with a 1 in. by 4 in. bolt interposed with a distance-piece of 1/2 in. by 3 1/2 in. tubing, as in Fig. 3. The flame-guard is made by bolting a piece of 1/2 in. by 12 in. tubing, flattened and suitably drilled at both ends, to two tubular side-members 1/2 in. diameter by 7 in. long. (Fig. 4.) Two 1/2 in. by 7 1/2 in. bolts will be required, and the assembly is securely bolted to the reflector, thus ensuring a particularly robust and rigid form of construction.

FIXING CLIPS

The clips securing the radiator assembly to the stove are preferably made from aluminium. Strips of suitable size are cut, and are bent around the stove supports with a pair of pliers. Holes are next drilled in the strips to correspond with those made in the reflector, and the assembly is then bolted to the stove-supports. The



This picture gives an idea of the finished job.

clips allow a certain amount of vertical movement to be made, and this is necessary in order to correctly position the heating cone over the burner. Experiment will decide the most satisfactory distance. In the writer's case the best position for the cone was found to be 1 in. above the burner.

The object should be to contain all the flame within the heating-cone, and also to heat the cone to a bright red to obtain the maximum radiation. When this has been attained, bolt the clips tightly to ensure a permanence of position.

PRE-HEATING THE BURNER

When lighting the stove, make very sure that the burner is sufficiently pre-heated with methylated spirit flame before applying air-pressure, otherwise a smoky flame will result and spoil the reflector. Also see that the stove is not in a draught, as otherwise the flame may be deviated from heating the cone, and the radiator's heating power will be correspondingly impaired.

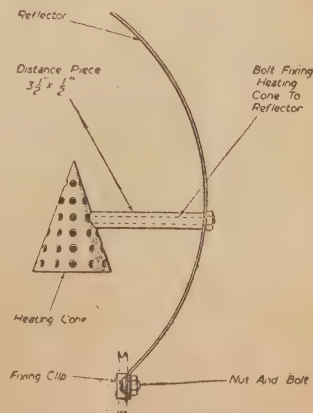
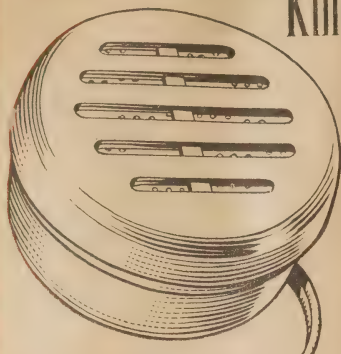


Fig. 3—Side view of reflector showing method of attaching heating cone and fixing clips.

LISTEN in COMFORT with a Kingsley "PILLO-FONE"



IT'S A REAL MINIATURE,
3½ diameter x 1½ deep.

Install it anywhere—on the verandah, in the sick room, workshop, garage or any room in the house. It is easy to connect to your present set. The Kingsley "PILLO-FONE" is the most convenient little speaker yet devised.

RETAIL PRICE --- 35/-

Write for details.

EXTENSION SPEAKER



In bed if you like—just place the "PILLO-FONE" Extension

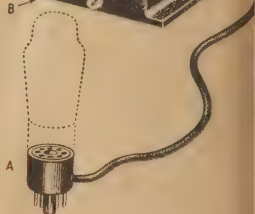
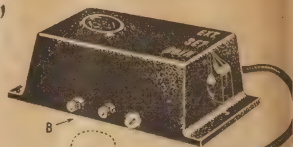
Speaker under your pillow and listen in real comfort . . .



For those who like to sit back in a quiet corner and enjoy listening, the "PILLO-FONE"

is the ideal Extension Speaker.

Now available in ivory colour plastic cover.



KINGSLEY ADAPTOR UNIT

With three-position switch, for operating Set and Extension, or both. It's the ideal unit for Extension Speakers . . . no technical knowledge needed . . . no wiring required . . . operation is simplicity itself. Remove output tube from receiver and insert adaptor (A), replacing output valve in the top of the adaptor. Connect the leads from the Extension Speaker to the terminals (B)

RETAIL PRICE --- 22/-

Here's the Kingsley KR6 Extension Speaker

In an attractive compact, all-metal cabinet

With a Kingsley Extension Speaker you can settle in your favorite nook and really enjoy listening in ANY ROOM IN THE HOUSE.

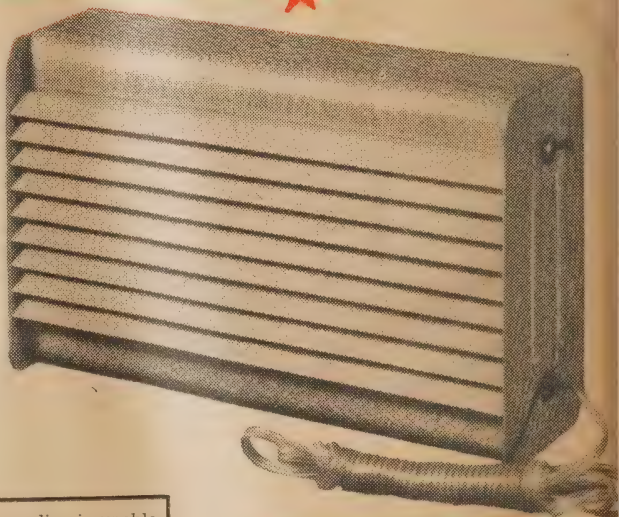
The Kingsley Extension Speaker, illustrated at right, is a dependable compact unit housed in an attractively finished modern metal cabinet. The unit employs a Kingsley six-inch permag speaker—type KR6. An "off-on" switch is located on the cabinet.

Installation is simple. Full directions accompany each unit.

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Ask for—Insist on—DEMAND Genuine Kingsley Parts.



IMPORTANT If your usual supplier is unable to supply your requirements of Kingsley Products, drop us a line mentioning his name and address.

Dimensions 11" x 7". Type KR6
Permag Speaker — 6ft. flex.



KINGSLEY RADIO

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SOME HELPFUL HINTS ON FILING

By MAURICE FINDLAY

A man who can use a file can make almost anything. This article tells you some of the main points to remember.

WHEN choosing a file, three points must be borne in mind, namely, length, grade of cut and general use. There are many different types available for different purposes, and usually pays to get the right one. The length of a file is the distance from its point to the heel, i.e., the handle is not included. This is an important point to remember.

Standard files can be divided into different grades of cut, namely:—
Rough, 20 teeth per inch.
Middle, 25 teeth per inch.
Bastard, 30 teeth per inch.
Second cut, 40 teeth per inch.
Smooth, 50 to 60 teeth per inch.
Dead smooth, 100 or more teeth per inch.

They can be further classified by their cross-section. Contrary to the popular idea, a great deal of practice is required to become proficient with the file. This applies particularly to producing work with a good, even finish. Make no mistake—filing is hard work, and one is apt to discover some new wrinkles in the process, particularly if one earns his living in an office!

GOOD LIGHT

To make things easier, the vice should be placed so that the light falls on the work. The work should come to the level of the elbow when standing erect. Remember, the file only works appreciably on the forward stroke, therefore most pressure should be exerted during this stroke, and relatively little on the return stroke.

Try to use all the cutting surface of the tool. This will give a more even finish and increases the life of the file.

It is essential when filing to be sure that the action comes from arm movement and not from body sway. Far in mind also that a slow, even stroke will produce far better results than a rough or jerky motion.

RAW FILING

For finishing work, and especially on thin edges, a method known as "raw-filing" can be used to produce a smooth and even surface. The file is placed on, and moved at right angles to, the length of the job. It is gripped in both hands between the thumb and remaining fingers in such a way as to enable it to be moved backwards and forwards smoothly in a straight line and at the same time prevent it from tipping sideways. Main, practice is the order of the day, but some very fine work can be turned out by a skilful operator. The finishing touch can then be given by rubbing a piece of emery cloth round the file and using it in much the same manner.

The cutting action of a file produces small chips of metal which sometimes become lodged between the teeth. If allowed to remain, these

will score the work as well as retard the cutting action. A brush with short wire bristles is used to remove these. It is called a "file-card," and is fitted with a wooden back and handle so that it can be conveniently brushed across the file in the line of the teeth. In most cases this process will be sufficient to remove all the offending particles of metal, but a strip of tinplate or thin sheet brass can be used for pieces too firmly wedged to be removed by the file-card.

SINGLE AND DOUBLE CUT

The cutting action of a file can be retarded to a certain extent to give a smoother finish (especially when draw filing) by rubbing it with ordinary blackboard chalk. The chalk can be removed afterwards by the file-card. It is not recommended to rap the file on the edge of the bench or the vice to remove the filings, because of the brittle nature of the metal from which it is made. It is very easy to break a file in this way, and even if a break does not occur, the teeth are likely to be chipped.

Many files are commonly available in either single or double cut. The single cut has unbroken rows of parallel teeth, while the double cut has an additional series of teeth cut at the opposite angle. Thus the cutting surface of a double-cut file is a series of closely-spaced sharp teeth.

It is good practice to use an old file to "break the surface" of a casting, because it is certain to have some grit left over from the casting process imbedded in its surface, and this will quickly spoil a new file.

RENEWING FILES

When a file has lost its cutting edge it is possible to restore it to some extent by treatment with a corrosive mixture.

Wash the file in hot water and brush with a file card to remove as much of the dirt and grease as possible. Obtain a wooden or enamel vessel of a suitable size and fill it with a mixture of 3 ounces of copper sulphate and three ounces of borax to each 1½ pints of water. If there are a number of files being treated turn them over so that the mixture can thoroughly penetrate the teeth. Then add 10 ounces of sulphuric acid and ½ ounce of vinegar, mix, and leave to stand. Some experimenting with the time may be necessary but as a general rule, coarse files will need to be given longer treatment. After the files are removed wash with clean water and give a light coat of oil to prevent traces of the liquid that may be left from having any further effect.

Filing is an essential part of practically every workshop project. The man who has become proficient with his file is a step nearer to turning out a good job. Good filing is an essential to the work of a craftsman.

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Since 1923 THE AUSTRALIAN TECHNICAL SCHOOLS, 3 Jamieson Street, Sydney, have trained students by CORRESPONDENCE in Diesel Engineering with MARKED SUCCESS.

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BATTLE OF WORDS IN ORIENT ASIATIC RADIO WAR

An interesting article which first appeared in The Sunday News of India and excerpts of which were given in a recent issue of Radio News, shows to what extent the various countries in Asia rely on radio broadcasts to further their political ideals.

ACCORDING to this article, by the end of next year there will be about 20 transmitters of 100 kw. or over, putting out entertainment or propaganda for Asiatic ears. Among the countries who are in the field are powerful transmitters, either operating or planned, are, Britain, USA, France, Holland, USSR, China, India and Siam.

The United States is one of the chief contenders for the Asiatic ear, and already has powerful transmitters operating in New York, Los Angeles, Honolulu, and Manila, and it is reported that an additional six 250 kw. are to be erected in the Philippines in order to reach an even larger audience.

It is also reported that the BBC will shortly take over control of the Singapore stations, and in addition will put into operation five or six new ones, each with a power of 100 kilowatts. The studios for these new stations will be in Singapore, but transmitters will actually be on the mainland in South Johore, where they will be looked after by a large technical staff of between 50 and 100.

The Dutch authorities are reported to have a 100 kw station planned for Batavia, which will be used in conjunction with those still under Dutch control, as distinct from those being operated by the Indonesian Republic.

Radio Saigon is to undergo extensive modernisation, which we would say is long overdue, as this station is now very poor, compared to what it was before the war.

Bangkok is to increase the power of their station in order to compete on an equal basis with her neighbors, while the new Dominion of Pakistan has already signified their intention of opening both broadcast and shortwave stations immediately the necessary equipment is available.

Chinese stations have always been difficult to follow, and the confusion seems likely to be even worse, as both the Nationalist Government and Communists intend to increase the number of stations they now control. The former hope to have four powerful shortwave outlets, operating from Shanghai, Chungking, Canton and Changchun. These stations, in addition to programmes for Chinese listeners, are to have other programmes for listeners in Europe, America and Australia.

Very little is known of what the Russians intend to do, but there are supposed to be 29 new stations provided for in the current Five Year Plan, and these are to be in operation by 1950.

From all the above it would seem we are to have many new stations to search for.

PEAK MONTH FOR LATIN AMERICA

THIS is the peak month for stations in Latin America, and though there are not a great number heard in this country, we are giving a list of those heard recently by Art Cushen in New Zealand, in the hope that some of them may break through. Our sister Dominion is certainly a DX-cra's Paradise, especially where these stations are concerned, but on a favorable day some of us may manage to log some of these elusive stations.

COCY, 11.735 mc., Havana, Cuba, back on the air to 4.3 pm daily, and signs off in English.

OAX5E, 6.17 mc., "Radio Chincha," Chincha, Peru. Signs off at 2.0 pm.

OAX4G, 6.095 mc., "Radio Lima," Lima, Peru. Signs off with the "Good Night Melody," at 2.45 pm.

YSUA, 6.25 mc., "Radio Mil Cincuenta," San Salvador. Closes at 3.0 pm.

TGJA, 6.235 mc., "Radio el Mundo," Guatemala. Good until 3.0 pm.

OAX6B, 6.038 mc., "Radio Lunda," Arequipa, Peru. Signs off at 3.0 pm.

LRR, 6.145 mc., Rosario, Argentina. Opens at 9.0 pm with news.

HJCV, 4.945 mc., "Emisora Sur-America," Bogota, Colombia. Off at 3.0 pm.

HJCD, 6.16 mc., "Nueva Granada," Bogota, Colombia, relays HJCB till 2.20 pm, signs off with a march.

HC2AK, 4.64 mc., "Radiodifusora del Ecuador," Guayaquil. Off at 3.30 pm.

OAXIB, 6.19 mc., "Radio Piura," Piura, Peru. Signs off at 2.30 pm.

XFOI, 6.015 mc., "Radio Mil," Mexico City. Signs off at 3.55 pm.

XEUZ, 6.12 mc., Mexico City. Heard at 10.0 pm, also signs off at 4.0 pm.

YV6RD VENEZUELA.—Ern Moore is very much in the news this month, and he kindly sent us the letter of verification he received from YV6RD. This took the form of a letter in Spanish with the station slogan at the top, "La Voz de Guayana," with the location, Ciudad Bolivar, below. On the right-hand side of the letter is the short-wave call, YV6RD 6.2 mc, and on the left, the broadcast band call, YV6RD 720 kc. Although this verification is not very attractive, it is a nice addition to Ern's collection, all the more so as we think he was the first listener to report this station to Radio and Hobbies.

SHORT Wave Notes for the September

issue are due on August 7. For the October issue they are due on Sept. 4. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

HJFH COLOMBIA.—Another very nice verification received by Ern Moore was one from HJFH, "La Voz de Armenia," which he heard some months ago on 4.875 mc. They sent along a very attractive card, a long letter in Spanish, and also nine small views of the station. In their letter the director, Miguel Angel Arango, stated that they were especially pleased to have the report on HJFH, as they were using new equipment between 6 and 10 km. The broadcast band call of this station is HJFH, and it operates on 1210 kc. We are very interested in this verification, as the writer obtained their verification about 10 years ago for 9.75 mc, which was a harmonic of their assigned frequency.

THIS MONTH'S NEW STATIONS

PAPUA.—The Australian Broadcasting Commission has recently opened a short-wave station in Port Moresby, Papua, which is to relay the programmes of the broadcast band station 6FA. Two outlets have already been heard, VLT5 on 7.2 mc, and VL7T on 9.52 mc. The first station can be heard nightly from 6.15 but, due to interference from an Indonesian, does not provide good entertainment level. The other outlet, VL7T, has been heard on a Saturday afternoon until closing at 6 pm, by which time it has reached quite good strength and is free from interference. This channel is probably also used during the week in the afternoons.

AUSTRALIA.—Two new outlets of Radio Australia have been logged during recent weeks, these being VLB2 on 9.6 mc in the programme directed to the British Isles and Europe from 6 am to 7.55 am. Listeners will remember that VLB2 used to be on 9.68 mc and, before that, on 9.71 mc. The other new station is VLG8, which operates on 9.68 mc directed to Africa, between 1.15 am and 2.15 am. This latter outlet is very poor strength at our location and difficult to follow. Listeners may not realise that there are a great number of our own short-wave stations on the air, and during the past few years we have received verifications from 75 of them, so this should be encouragement for young listeners who are just taking up the hobby.

DUTCH BORNEO.—We do not seem to have listed a new station which has been heard for some time now until closing at 10 pm. We refer to station YDZ, which operates on 4.895 mc and which is located on Biak Island, off the north coast of Borneo. Between 9.30 pm and 10 pm the station plays Western-type recordings which are interspersed with announcements in English by a lady. At the conclusion of the programme the following announcement can be heard, "You have been listening to the General Network Station YDZ, Biak Island, on 4.895 mc. We invite you to listen tomorrow night at the same time and on the same frequency." Goodnight, listeners, and happy dreams." Strength of this one is quite good.

ANGOLA.—For some weeks now we have been hearing a Portuguese-speaking station on 8.085 mc which closes with their National Anthem at 7 am. On two occasions we heard the words Lourdes Marques mentioned, though the programme was not the same as any of the Moxambique stations on the air at the time. Art Cushen expressed the view that it may be an outlet of CR6AA Angola, and now we note from Radio Australia that this new station is in contact with the Luanda station CR6RA, and on the air from 5.30 am till 7 am. The new station is probably operated by the Radio Club de Angola.

VENEZUELA.—Our valued Brisbane listener Ern Moore tells us of a new Venezuelan station he is now hearing. This new one is "Radio Barquisimeto YV3RN, which uses a frequency of 4.5 mc and comes on the air at 8.30 pm with a march, followed by station announcements giving the call letters, station slogan and the location. The station then gives a musical programme with announcements in Spanish, so good material should be available to compile a report. The other Venezuelans on this band can also be heard at the same time, YV4B on 4.75 mc, YVIRI on 4.81 mc, and YV5RM on 4.97 mc, the latter usually being the loudest at our location. No level is rather high, but these stations can be heard in the first part of programme.

CASHES FROM VERYWHERE

KENYA - UGANDA - TANGANYIKA.—Thanks are due to Radio News for information regarding the Gatti-Halliers Expedition to Africa's Mountain Moon. The expedition has been called letters and frequencies by Conference of East African Governors. Call letters are as follows: **Kenya** VQ5GHE, **Kenya** VQ4GHE, **Uganda** (mobile) VQ5HEG, and **Tanganyika** VQ3HGE; frequencies assigned are 0 mc, 7.0-7.2 mc, 28-30 mc, and 60 mc. Listeners in the USA have already heard these transmitters on 28.375 on phone and on 28.05 mc, using c.w. The expedition is keeping in constant touch with the outside world as it makes way through Kenya, Uganda, and Tanganyika, visiting obscure tribes of nomads and giant Watutsi. When the expedition reaches the Mountains of the Moon, they will explore the mysterious Lakes of the Ruwenzori.

The best time to listen for these stations is in the early hours of the morning. If you are lucky enough to log any of them you can send a report to Commander Attilio Gatti, leader of the expedition. The address is simply Base p. 7, Kenya, Base Camp, Uganda, or Base Camp, Tanganyika. According to the Radio News their verification cards are attractive, so should be well worth port.

AMERILOONS.—The well-known Amerilistener Paul Kary has recently received a verification from Radio Douala in the Cameroons. They made their reply by air mail and advised that their transmitter was a Temco with an output of 750 watts and operating on 7.95 mc. The schedule was given as 4 am to 6 am, c.w., but on Mondays runs until 7 am. The music is given between 4 am and 4.30 am, local and world news in French from 4.30 am to 4.50 am, French 4.50 am to 6 am, "Varietes Douala" 6 am to 6.15 am, and concert music 6.15 am to 6 am. On Mondays, uninterrupted music is given from 6 am to 7 am. The session is shortly to be used from 7 pm to 10.45 pm, and on the 2nd, 16th and 17th of each month they verify listeners' letters at 4.25 am.

JUTCH WEST INDIES.—Stations from all parts of the globe are rarely received in Australia, and it may be of interest to know that PJ2C on 7.25 mc, based in Willemstad in Curacao, and is known as "Radio Princess Juliana." It has a powerful beam in the direction of Australia at 11 am. It is very doubtful, however, if this could be heard in this country, as the time and frequency is not able.

Another station which has been heard recently is Paramaribo in Suriname, which uses P2R on 15.402 mc. This output is being used in parallel with PZHS on a frequency of 5.757 mc, and times on air are stated to be 12.30 am to 2 am, 4 am to 1 pm, while on Mondays the first hour is till 4 am.

ANGOLA.—Our valued correspondent south Africa, Mr. Mervyn P. Laubscher, sent us the following details of the Angola stations, CR6RB 9.165 mc, CR6RF 9.165 mc, Radio Clube de Benguela 9.15 to 10 pm and 3.30 am to 5 am. Verified with a nice card from Caixa Postal 19, Benguela.

ANGOLA. 9.235 mc Radio Clube de Huila, 9 pm to 10.45 pm on Sunday, and also 3 am to 5 am both weekdays and Saturdays. Their address is Caixa Postal 5 da Banderla.

ANGOLA. 8.242 mc Radio Diamang, Dundo 9 pm to 10.45 pm.

ANGOLA. 7.152 mc Radio Clube de Novo, Nova Lisboa. 9.15 pm to 10.15 4.30 am to 5.30 am.

ANGOLA. 7.177 mc Radio Radiodifusora de Luanda. A real old-time station, and leaving the air at 5.30 am.

ANGOLA. 7.14 mc Radio Clube de Malange 9 pm to 6 pm, 10.30 pm to 11.30 pm. Verified, Caixa Postal 83, Malange.

ANGOLA. 7.77 mc Radio Clube do Mocimboa 6 am to 7 am.

ANGOLA. 7.058 mc Radio Clube do tul de Luanda, Lobito. 9 pm to 9.30 pm, 3 am to 5 am, and 5 am to 7 am.

NEW STATION LOGGINGS

Call	KC	Metres	LOCATION	Time heard
HHCA	4600	65.22	Port-au-Prince, Haiti.	9.30 pm
YDZ	4895	61.29	Biak Island	9.30 pm
YVIRV	4940	60.73	Barquisimeto, Venezuela.	9.00 pm
VLT5	7280	41.21	Port Moresby, Papua.	8.00 pm
CR6	8085	37.11	Luanda, Angola.	6.30 am
VLT7	9520	31.51	Port Moresby, Papua.	5.30 pm
VLB2	9650	31.09	Shepparton, Vic.	6.30 am
VLG8	9680	30.99	Lyndhurst, Vic.	1.15 am

UNION DEFENCE

We are indebted to Mr. John Borg, of Glebe, Sydney, for an interesting article he sent us, taken from the South African magazine, The Outspan, giving some interesting information concerning the now well-known station ZRB.

The article was written by Major N. Thomas, Officer Commanding the Pretoria Signals Training School, No. 64, and we quote as follows:—This radio station, the first of its kind in South Africa, is a bold experiment by the signals section of the SAAF, and is designed to fulfil a variety of useful purposes throughout the country. Airmen, both military and civilian, will get first-hand, up-to-date weather information, news about the serviceability of aerodromes and other facts likely to be of value to pilots operating in the Union. Radio ZRB is yet another step forward in the interests of flying safety, and the scheme, therefore, has the blessing of the Civil Aviation Council of South Africa, which is constantly striving for more safety measures and a high standard of reliability in flying.

EMERGENCY USE

The potentialities of ZRB in any national emergency are great. In the event of a sudden Union-wide mobilisation being necessary, speed of communication with all CAF units is the key to success, and this new UDF project is the only modern way to achieve this.

Had there been such a system operating and established in 1939, a great deal of work and time would have been saved. When the blue print of this scheme first became the centre of discussion around the conference table, it was realised that it would be doomed to failure from the start were it to be a continuous, monotonous series of official announcements, rather like a broadcast adaption of a Government Gazette. Some form of entertainment had to be introduced to secure and retain the interest of the listening public.

This was a novel angle, but not without its problems. Broadcasting in South Africa is a rather strictly controlled business, and it is not merely a matter of erecting a transmitter and putting on a series of gramophone records.

The UDF sought the co-operation of various officials, including the representatives of the South African Broadcasting Corp. After help and cordial discussions, an excellent arrangement was arrived at.

In addition to the above, there are also the various transmitters of Radio Clube de Angola located at Luanda. These have been listed in our pages on previous occasions.

ICELAND.—This country has always seemed to have a fascination for listeners in our country, and we have had many letters at different times as to when it can be heard. Thanks to Jim Paris, of Prospect, South Australia, who has recently received a letter direct from the station, we are able to give the latest information on TFJ, which is owned and operated by the Iceland State Broadcast Service in the capital, Reykjavik. The station is now using a frequency of 12.175 mc instead of their old one of 12.235 mc, and are on the air on Mondays only from 2.15 am to 2.45 am, with a programme in Icelandic directed to Scandinavia and intended for Icelanders

Radio ZRB will have special facilities to tap either the English or Afrikaans Johannesburg programmes for items of entertainment whenever it wishes, and will also be supplied with gramophone programmes during the SABC's daily silent periods.

Radio ZRB is therefore a new source of broadcast entertainment for South African listeners, while at the same time performing an essential and useful service to the country.

THE TRANSMITTER

Now something about the actual transmitter itself—how, when, where, and why? The last question has already been answered, so on to the others. The use of one of the Air Force Signals' most up-to-date shortwave transmitters was available for the service. It is a 5 kw. shortwave transmitter, as powerful as the well-known Laurence Marques station, and equal in output to the "B" short wave transmitter of the Johannesburg station of the South African Broadcasting Corporation. By reason of the frequencies on which it will operate, 7.445 and 9.11 mc, it will be powerfully audible throughout South Africa, easily recognised and possessing a quality and stability in conformity with the latest developments of radio science (ZRB has been heard both in Australia and the USA—Editor.) Long experiments have been conducted, adjustments made and changes effected. Special lines have been laid to carry the "A" and "B" SABC programmes to the transmitter, and reports have been received and collated to furnish valuable data to the SAAF Signals radio engineers.

LOCATION

The transmitter is erected at the Waterkloof air station, near General Headquarters, Pretoria, and its aerials have been so designed as to radiate broadcast energy to the south, taking in the Orange Free State, and the eastern and southern areas of the Cape, and the east, embracing the Eastern Transvaal and Natal.

Readers will see from the above that this is truly a very interesting station, and a little away from the ordinary. They send quite a nice verification card for correct reports, and no difficulty should be experienced in hearing it just now any time from just after midnight.

abroad. Power of the station is 7 kw, and address, Box 1025, Reykjavik, Iceland.

AFGHANISTAN.—This is indeed an unusual country so far as short-wave stations are concerned, and we doubt if anyone in this country has logged any, or, we should say, logged and identified them. In a recent session from Radio Australia we hear of a station transmitting programmes in Afghan on a frequency of 7.95 mc on Mondays, Fridays only from 2.30 am to 3.30 am. The opening announcement is "Injau Herat." Herat is in the west of Afghanistan, and has a population of over 100,000. Another station giving Afghan programmes transmits on 6.945 mc on Mondays and Thursdays only, and is also on the air between 2.30 am and 3.30 am. The location of this latter station is not known.



THE FIRM FOR ALL YOUR RADIO REQUISITES



TRANSFORMERS (SPECIALS)

230 Volt Primary, 150 volt aside 30 m/A, 6.3 volt at 2 amp. secondary. Dimensions 2 1/2 x 2 x 2 1/4. Ideal for the miniature A.C. receiver. These are brand new and have just been released. Easily worth 18/6.

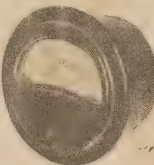
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We also have a few of the following transformers left, so order what you require now.

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We have a large range of branded lines and we can also wind special transformers to suit every particular job. Let us know your requirements and we will forward full information.



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Large A.C. volt Meter: Overall dimensions 5 1/2" in solid black crackle finished metal case. Measures 0-300 volts and has an uncalibrated scale. An excellent meter.

Worth £6/10/-. Our Price £2/10/-.

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Micro Switches 2/3

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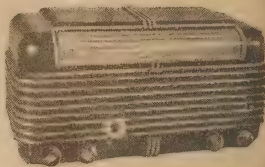
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Our Mail Order Department is one of the largest in the Commonwealth and is capable of handling the largest or the smallest order in the shortest possible time. Whether you are in New Zealand or Perth, your order will receive the same courteous attention as our Melbourne client receives. Why not let us add your name to our mailing list.

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If you are wanting a good position, why not contact our Radio Department Manager. He will be only too pleased to advise you of the excellent working conditions and the amenities that are provided for our staff. You learn while you work.



A SPECIAL BARGAIN

Cadet 5 Valve B/C Vibrator Mantle Radio.

In bakelite cabinet, brand new and perfect in appearance and performance. These sets have been purchased at very low cost so that we are able to pass this saving on to you. Original price was £30.

OUR PRICE 18 gns.

A 6 volt battery for this set, £2/19/6 extra.

Also a console set as above .. 21 gns.

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We have a few of this very popular model left. Equipped with 9 valves and 2 power supplies. Frequency range 4-7 mc/s.

OUR PRICE £8/10/-
Less power pack but with valves .. £6

No. 19 Transceiver Cables

with two large 12-pin plugs.

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(State lengths required).

Junction Boxes for the No. 19 Transceiver. OUR PRICE, each 7/6
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Electro Dynamic Speakers

8" with a field of 1500 ohms and 5000 Transformer. This is another bargain line.

We are selling them 19/11
for only, ea.



MOTOR SPARES LTD.

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THE HAM BANDS WITH BILL MOORE

Some excellent work was performed by amateurs during the recent devastating floods that swept the North Coast in mid July. Fortunately, public communication channels were kept open and the scope for amateur activity was limited.

Murwillumbah Norm Carpenter, VK2RK, opened on 7010kc, and broad-
bulletins issued by the local flood
relief. On the morning of the 14th
power lines from Brisbane were out
for four hours and the local broadcast
on closed. The breakdown was an-
nounced and an announcement was
made over the broadcast station to the
effect that VK2RK would broadcast warn-
ings.

These were issued at 10-minute in-
tervals until the power was restored to
local B/c station. The transmitter
operated from batteries and a gener-
ator supplied by a local radio dealer.
When in Maclean VK2OE was requested
the local postmaster to stand by in
of emergency, which, fortunately,
did not eventuate. VK2GI at Woodford
had, on the Clarence, suffered greatly
from flood damage; he was without
power for three days. His diode monitor
put to good use to receive flood
warnings from the local B/c station.

Several amateurs saw their shacks
completely flooded, but most of the
equipment had been removed to higher
ground or stored in roofs. VK2NY saw
his floating in five feet of water.
LH found a strange car in his garage
VK2XO's gear ended up in the roof
of his garage. 2ADE, 2SL and 2TB, be-
sides others, stood by in case of emer-
gency.

A review of the flood from a com-
munications viewpoint a strong move is
being made to organise a net of battery-operated
amateurs and the North Coast amateurs
are to be congratulated on their initia-

INTERFERENCE ON AMATEUR BANDS

THE department has been giving pub-
licity over WIA stations showing the
need of fullest co-operation from licencees
to keep inter-station interference down
to a minimum.

It is reported that much of the in-
terference is brought about by the failure
of operators to observe the instructions
contained in paragraphs 110, 133, 136, 137
of "The Handbook."

The main points covered in these para-
graphs are as follows:—

On bands from 144 Mc. upwards, ex-
cept for brief tests or adjustments, car-
riers must not be emitted unless intel-
ligibly modulated.

Prolonged calls must be avoided.
Operators must listen out on the fre-
quency they propose to use before trans-
mitting and see the channel is clear.

They must also effectively monitor their
transmissions.

The transmission of signals not neces-
sary for the conducting of experiments
or conversations is absolutely forbidden.

If the above points are kept in mind
and observed, there is no doubt our
interference problem can be reduced.

WIA NEWS

THE results of the NSW Division's elec-
tion of councillors to specific positions
was recently announced. The full divi-
sional council and the positions held are
as follows: President, Morrie Meyers,
VK2VN; vice-presidents, John Moyle,
VK2TU, and Fred Treharne, VK2BM; sec-
retary, Wal Nye, VK2XU; treasurer, Brian
Anderson, VK2AND; technical officer,
Naughton Macnaughton, VK2ZH; disposals
officer, Clive Hutchison, VK2YP; QSL
officer, Jim Corbin, VK2YC; councillor,
Arthur Thurston, VK2AV.

REMEMBRANCE DAY

THE WIA will run, during August, the
first of a series of annual Remem-
brance Day contests to perpetuate the
memory of Australian amateurs who gave
their lives in the 1939-45 war. The names
of these amateurs, together with their
signs, will be engraved on the trophy,
which will be competed for by the various
divisions of the WIA.
The contest will be held every year
the weekend nearest August 15th, the
day of the war in the South Pacific area.
This year's contest will be held on
the weekend August 14th and 15th. Full
details will be published in "Amateur
Radio" and announced over WIA official
stations.

PHONETICS

WE hear some very unconventional
examples in the various phonetics
used on our amateur bands. At the last
general convention of the WIA it was
decided to adopt a standard phonetic
alphabet for Australian use. The De-
partment offers one for general use in
our handbook for the operators of
amateur wireless stations.

Whilst some of the phonetics used, al-
though generally not accepted, they are
within reasonable bounds. Some operators
recently in their endeavors to be humor-
ous have been getting out of bounds.
A classical example from a Victorian
station working G3BUU, was G3 "Black
unwashed undies." It looks rather crude
and sounded just as bad over the
air. The YF happened to hear it
and her comment couldn't be printed.

It is a point that all operators should re-
member is the fact that we are too often
regarded by "John Citizen" from whom
we hear on his dual-waver. There is one
other fact, that "John," on hearing of
black unwashed undies on the ham
bands, would wonder what demented
person occupies those bands. If we are to
keep our position as members of a re-
spected hobby, our general behavior on
air must be watched.

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helpful, informative, POPULAR PHOTOGRAPHY has proven itself
the best guide to better camera technique. You can have each
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currency. Orders placed now will start with the September issue.

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26 O'Connell Street, Sydney. Phone BW5170.

I am enclosing \$_____ Please arrange to have the
following magazines posted to me for 1 year:

POPULAR PHOTOGRAPHY (25/6), POPULAR MECHANICS
(22/6), COLLIER'S (50/-), WOMAN'S HOME COMPANION
(22/6), LIFE (49/-), LOOK (32/6), POPULAR SCIENCE (22/6).
(Cross out those not required, rates shown are for 1 year's supply)

NAME _____

ADDRESS _____

R.H.

The following members were reappointed to positions held during the past twelve months: Chas. Fryar, VK2NP, UHF officer; Roy Egan, VK2ARE, traffic manager; Allan Appleyby, VK2BF, AOCF class manager.

The new council has quite a lot of new ideas and are working to extend executive duties to cover as many members as possible to prevent too much work falling on any one person.

The following Victorian amateurs are serving as members of the Federal executive for the forthcoming year: Federal president, W. Gronow, VK3WG; vice-president, A. Glover, VK3AG; secretary, W. Mitchell, VK3UM; treasurer, A. Evans, VK3VQ, and publicity officer, G. Manning, VK3XJ.

WIA BROADCASTS

A New schedule for Australian-wide Wireless Institute of Australia broadcasts has come into operation.

All broadcasts will now be made on 7196Kcs. The different State stations will operate at the following times:

VK3WIA, 900 hours, VK4WI, 0930 hours, VK7WI, 1000 hours; VK5WI, 1030 hours, VK2WI, 1100 hours, VK3WI, 1130 hours, and VK6WI, 1200 hours. All times Eastern Australian Standard time.

Most WIA stations will change frequency for intra-state contact immediately on the conclusion of the official broadcast to clear 7196Kcs. for the next station.

These broadcasts are becoming increasingly popular and supply amateurs with the latest news on WIA affairs and general amateur doings. VK3WIA is the call sign of the Federal executive.

ARRL BOARD MEETS

SEVERAL items appearing on the agenda for the 1948 ARRL Board of Directors meetings will have international repercussions if adopted.

The first is a suggestion that the American phone allocation in the new 21mc be used exclusively for single-side band suppressed carrier transmissions. The idea is certainly revolutionary and a step in the right direction, towards a reduction in telephony interference.

The second point covers the introduction of a regulation to substantially confine phone radiation to a band width of 6kc.

Of the remaining agenda items, they are mostly confined to domestic matters and many are the ideas on a re-allocation of the administrative positions at headquarters.

THE U.H.F.'s

THE 144mc field day staged by the Gladesville Radio Club was extremely successful and together with the various home stations around Sydney 21 stations were active.

Stations operated by club members were located at Hornsby, Prospect, Beacon Hill, Brookvale, Engadine and Bringley. Modulated oscillators and super regenerative receivers were used.

The highlight of the day was a 288mc/144mc crossband contact between VK2KI located at Hazelbrook, Blue Mountains, and VK2YE at Engadine, south of Sydney. Distance covered 40 miles. VK2KI on 288 mc used 21 watts to a three element beam.

Frank Nolan, VK4FN, reported hearing NSW signals back on June 6 at 1900 hours. This report checks with the logs of VK2YJ and VK2VW, who were active at the time. 660 miles is the record for a two-way contact in the US.

50mc opened up on July 4 for an hour. VK4BT, putting an S9 signal into Sydney from 400 hours onwards, 4BT was first heard by VK2LY at 1400 hours and was contacted by VK2NO and by VK2ADT, of Cessnock. During the evening VK5QR reported to 2NO that his signals were audible in Adelaide and the fact that VK4BT had contacted a VK7 during the day.

Ray Howe, VK2ARR, lectured at the July NSW UHF section meeting, subject, "Antennae." The contest committee

submitted rules for a UHF contest to be run from September to December on 50, 144 and 288 mcs.

RADIO CLUBS

RECENTLY formed is "The Geelong Amateur Radio Club," with the inaugural meeting on June 15. President is VK5ABC; vice-presidents, VK3AKE and VK3SY; secretary, VK3IC; and treasurer, VK3AJF. For those interested the secretary's address is 158 Kilgour-street, South Geelong. The above news comes from the publicity officer, VK3ALG.

In NSW two country radio clubs are doing excellent jobs in helping locals to obtain their AOCF. In Wollongong the Wollongong Amateur Radio Club meets at the Technical College on Friday evenings. The secretary is Reg Waters, VK2WV, 8 Bourke-street, Wollongong. The secretary of the Newcastle Amateur Radio Club is Bill Pearce, VK2CW, 70 Waratah-street, Mayfield. Both these gentlemen will be pleased to supply information on their respective clubs.

VR2AM MOBILE MARINE

THOR GUNDERSON, who used to operate on the SS "Tambua" on the Australian coast as VK4AM mobile marine, can now be heard on 40 metres using his other call, VR2AM/M. He anticipates relinquishing his VK4 call sign shortly, as he does not expect to return to Australia. In lieu he has taken out ZL1BU as a call sign. Now aboard the SS "Nauri Panare" he uses 15 watts to ZC1 (NZ) dispatches gear which he prefers to the FS8. Thor must hold some sort of record with a current call in three countries, VR, ZL and VK.

NEW PREFIXES

SEVERAL prefixes for countries have been changed in recent months.

The South African native territories now sign:

ZS7—Swaziland.

ZS8—Basutoland.

ZS9—Betchuanaland.

American amateurs in the Far East Command will sign as follows:

Korea—HL1AA—ZZ.

Okinawa and Ryukyu is—KR6AA—ZZ.

Bonin is—K66A—IZ.

Marshall is—KX6AA—ZZ.

Marianas is—KG6AA—AZ.

Others include:

Trieste—MF2.

Germany (French)—D5.

PERSONAL AND DX

WELL-KNOWN DXer W7VY has been heard on telephony from XE1A, though latter with a few KV on 14.000kc. Though old VY would know better than to clutter up that end of the band with phone.

2DC/P08 has been active most evenings on stilted CW. Can't find out what the 2DC signifies. Heard on 40—VK? APM—VH "Australian Prime Ministers."

About 2100 hours on 14mc VQ8CB or Chagos Archipelago has been active. The Australian DX gang has been standing by but W7VY seems to monopolise the VQ.

VK2ACU describes his folded dipole as a barber's pole, the twin lead going round and round. Nice DX in YNIMF on 14075 at 1900 hours, slight chirp and rather weak.

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AT last you are able to learn all branches of Art under the supervision of this famous Australian artist. Amazing short-cut method simplifies art. You learn at home.

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NEVER before has a book of this nature been offered free. That is why you should send for your copy now. It shows you how to draw—develop your talent—how to cartoon, the secret of illustrating, etc. Fill in the coupon and send at once—NOW!

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- How to Draw Figures.
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- How to Make Money in Your Spare Time.
- How to Develop Latent Ability.
- How to Cartoon.
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- How to Sell Your Work.
- How to Illustrate for the Papers.
- How to Sketch and Draw.

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And join the ranks of licensed amateur transmitters. The W.I.A. holds regular classes in theory, practical work, and code. Fully qualified instructors.

Write for particulars to the Amateur's official organisation
THE WIRELESS INSTITUTE OF AUSTRALIA.
Class Manager, Box 1734, GPO, Sydney.

HOW TO USE YOUR OSCILLOSCOPE

(Continued from Page 73)

a shape rather like an elongated "8". This "linearity" check is extremely useful by reason of its ability to reveal distortion non-linearity, phase shift, and, lastly, frequency response.

To observe frequency response the line or ellipse is adjusted, with the amplifier delivering moderate power so that it is at a convenient angle—say, 45 degrees.

LINEARITY

The input frequency is then varied and if the amplifier response is level, and the CRO controls are not touched, the line or ellipse will maintain the 45 degrees slope. Variations in the output of the audio signal generator will lengthen the line or ellipse, but will not affect the slope. However, variations in amplifier frequency response will cause the slope of the line to become steeper or otherwise—depending on whether the output-input ratio is decreasing or increasing.

As in the case of wave-form observation, familiarity with patterns will enable the observer to gauge accurately just what is going on in any amplifier under test.

Distinct from signal frequency tests, a CRO is very useful for observing and correcting hum level. It will certainly reveal hum far more clearly than a listening test. The first check is to ascertain the frequency of the hum, and for this purpose the idea is to feed the output of the amplifier into the vertical plates and a 50-cycle voltage into the horizontal plates, setting the CRO to "external sweep."

If the hum is predominantly 50-cycle the pattern will be like a rather maltreated circle, whereas 100-cycle hum would produce a figure "8" similarly battered. This itself is significant in that 50-cycle hum must originate from direct electromagnetic or electrostatic effects, or from heater cathode leakage. On the other hand, a 100-cycle ripple can only be produced by full-wave rectifier and filter system.

Having determined the nature of the hum it is then a simple matter to take corrective measures and observe the effects on the CR tube pattern.

The use of a CRO in the "ham shack" opens up a completely new field, but this will form the basis of a separate article.



**SOUNDS LIKE A GOOD TIP
TO ME . . . BUT WHAT IS
DUCONAL "A"?**

Duconal "A" is a new synthetic treating material used in Ducon Capacitors. Product of many years research, it has supplied a complete answer to capacitor problems.

In practice Duconal "A" has proved itself immeasurably superior to other types of commonly used impregnants. Duconal "A" is exclusive to Ducon Capacitors.

NEW MAGNETIC FLUID CLUTCH

(Continued from Page 17)

indicate that the electromagnetic fluid clutch has numerous advantages over many other existing types. It is characterized by extreme smoothness of action, because all contacting surfaces, both of the plates and of the iron powder, are coated by a lubricant.

EASY CONTROL

The clutch is easy to control and requires but small amounts of electrical power. The control is extremely smooth from the minimum, which is determined by the viscous drag of the oil, to the maximum, saturation of the iron. Unlike other electromagnetic clutches that follow a square law, wherein the torque is proportional to the square of the electric current, torque in the new clutch is proportional to the control current over a wide range of torque values. Hence, the clutch is particularly suitable to servo-mechanism applications where linearity and good control down to zero current are of primary importance.

Another unusual and desirable feature found in some forms of the magnetic fluid clutch is that the value of static friction does not differ appreciably from the value of kinetic friction; hence no discontinuities in torque exist at the moment of initiation of slip. This feature is one of the principal reasons for smoothness of the clutch action, since chattering in an ordinary dry-friction clutch is due mainly to the difference between static and kinetic friction.

Because it has no axially moving

parts, the clutch is extremely easy to build, consisting essentially of a driving and a driven member that do not change relative position, except in rotation. As slipping occurs only between extremely fine iron particles and between the iron particles and smooth face surfaces of the clutch, and as all the surfaces are lubricated, wear is practically non-existent.

LOW WEAR

Moreover, if any of the surfaces are worn off, the iron dust thus generated simply adds to the iron powder already in the oil mixture. The gaps, as normally employed, are fairly large; therefore, any such wear will have negligible effect. In the clutches tested at the Bureau, no wear has been noted, but because extensive life tests have not yet been run, it is not possible to rule out wear completely.

PUTTING A GLOW INTO PLASTIC

PHOSPHORESCENT plastics that glow for as long as 12 hours after exposure to light are now available for commercial uses. Promising new tricks galore for the ever-growing field of plastic products, the glow is achieved by adding special pigments to existing plastic compounds, which are otherwise unchanged. Possible applications include indoor and outdoor signs, light switches, ornaments, instrument panels—anything a manufacturer wants to make visible in the dark without bothering about a continuous power supply.

- Duconal "A" permits reduced size of capacitors.
- Is non-inflammable.
- Characteristics permanent.
- Higher dielectric strength.
- Permits of many new applications.
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OFF THE RECORD — NEWS & REVIEWS

Several readers have written to me lately asking my advice on the use of sapphire needles. It is impossible to answer this question without making several important reservations.

By JOHN MOYLE

A SAPHIRE point is of its nature very hard, and somewhat brittle, making it susceptible to chipping under sharp, sudden blows.

Because it is hard, it will play many records without appreciable wear. Conversely, unless the tip is very lightly loaded, it will tend to wear away the record more than steel needles, which are themselves worn away as the record is played.

The sapphire, therefore, shows up best when used with some of the latest type pick-ups which have a very lightly damped movement and impose much less weight on the record than older types. As a rule such pick-ups are fitted with their own sapphires, although it is possible to buy special sapphires for such pick-ups.

A CAUTION

Because the sapphire is hard, when it does wear it takes on a chisel-like point. If the needle in this state is revolved in the needle chuck, its sharp edges will rapidly wear down the record grooves. Sapphire needles, therefore, should be used warily with pick-ups in which they cannot be firmly fixed in one position, so that they cannot revolve during use.

The older type pick-ups, and even many crystal types, are not ideally suited to sapphire needles. Record cracks and scores can easily make minute chips on the point, not visible without a magni-

fying glass. The cutting action of such a chipped point is made much worse by the extra weight of the pick-up head. And of course, the greatest care must be taken in handling.

New Records

DEATH AND TRANSFIGURATION, Op. 24 (Strauss) played by the Philadelphia Orchestra conducted by Ormandy. LOX663-5.

This is one of Strauss' well-known tone-poems, the original score of which I believe is held by Professor Bernhard Heinze, Melbourne's Ormond Professor of Music and which I heard his orchestra play for the first time in Australia many years ago.

The title well describes the theme of the music, which commences quietly and impressively, indicative of the grief and hushed atmosphere of death. It builds up to a climax, proceeding through a succession of appropriate themes, striking eventually the exaltation of elevation to a new and bigger life.

Musically one could not mistake the lavish and richly orchestrated style typical of Strauss, although the very nature of the work makes it possibly a little less attractive and slower in tempo than for instance, "Don Juan."

The recording appears to have been done at the same time as the Dvorak Symphony reviewed in our last issue. It has much the same close-up recording, but it is much more successful with this type of music, where an abundance of detail and color is so essential. There is some beautiful playing to be heard. The Philadelphia orchestra is completely at home in work of this kind. The recording generally is well up to standard.

DALLAS SYMPHONY ORCHESTRA (and, by Antal Dorati) "The Seasons" Ballet Suite (Glazounov) H.M.V. ED.658/61.

Some of this ballet music you will recognize through its use as theme music for a couple of well-known radio serials. I don't put this forward as a recommendation, but there it is.

Mostly, the "Seasons" is melodious music, at times more intelligible when heard with a ballet than alone. Again, I don't imply that it is any the worse for that—on the contrary one has seen the ballet, the music takes on a charm of both the ear and of the recollection. (Petrouchka is perhaps the best example of this.)

The recording is rather light in character, although there is plenty of breadth to give the impression of a full orchestra at work. Most of the American recordings incline this way—rarely do they exhibit the full throated impression which English engineers regard as normal and desirable. On the other hand it is very clean. For that matter, so is the playing itself.

This is the first release here of the Dallas orchestra, and a very good introduction it is. It shows evidence of good training, its attack and uniformity are particularly good, and it is quite at home with the music. You will find this the most attractive set.

ALFREDO CAMPOLI, Violin, Piano acc. by Eric Gritton—"Sonata in G Minor" Tartini and "Arioso" (Bach). DECCA Z.909/10.

A beautifully played set of records remarkable for their pure violin tone. Campoli has judged the mood splendidly, and exhibits a marked suitability for such music. The contrast between this work and the others reviewed here from the

same lists no doubt high-lighted the smooth, "music for music's sake" atmosphere of the sonata. I think I enjoyed as well as any of them.

LUIGI INFANTINO, Tenor, with Philharmonic Orchestra—"Sunnanne A Pusilleco" and "Torna A Surriento" COLUMBIA DO.3149.

A pleasant voice but not quite enough abandonment for the music. Particularly as we have some records sung by men to whom songs like these are meat and drink. Still, you may like them sung this way, and if you do you won't begrudge your shillings for this one.

THE GEORGE MELACHRINO STRING ORCH.—"Estrellita" and "El Relicario" H.M.V. EA.3691.

This is a very pleasantly played record, interesting in arrangement, and satisfying in execution. The items are among the best known in light programmes and are, by and large, as good as any I have heard. The sweet and swirling string work suits them admirably.

ANNE ZIEGLER & WEBSTER BOOTH, Vocal Duet, with Orchestra—"Love Me Tonight" and "Tomorrow." H.M.V. EA.3692.

These two are always welcome, particularly Webster Booth who seems to be able to sing anything with equal ease. You can't go wrong.

LONDON SYMPHONY ORCHESTRA (cond. by Malcolm Sainsbury) "Jamaican Song: Jamaican Rumba" and "Men of Arnhem." DECCA Z.904.

This record really sounds like an orchestra, accentuating my remarks about the difference in English and American recording technique. It lacks a little in extreme definition, but the music is of the massed type in which such definition isn't really required.

"The Jamaican Rumba," which has been the subject of several recent recordings, I thought the most attractive of the three. The "Men of Arnhem" March is pretty typical music of the movies, and you will like it if you are inclined that way. Its quite a good disc.

Other Releases This Month

H.M.V.

FREDDY MARTIN & HIS ORCH.—"Piano Portrait" and "Dingbat The Singing Cat." EA.3709.

SPIKE JONES & HIS CITY SLICKERS.—"The Pop Corn Sack" and "Our Hour" (The Pappy Love Song). EA.3710.

GLENN MILLER & HIS ORCHESTRA.—"My Melancholy Baby" and "Here we Go Again." EA.3711.

JOE LOSS & HIS ORCHESTRA.—"Chi-Baba Chi-Baba" and "Happy-Go-Lucky You." EA.3712.

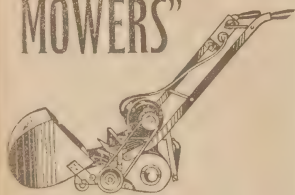
"FATS" WALLER & HIS BUDDIES.—"Harlem Fuss" Fats Waller (pno); with A. Harris (Clt & Alto); C. Gains (Tpt); C. Jervis (Tmb); E. C. Condon (Bjo); (Recorded March 1, 1929) and "Won't You Get Off It Please" Fats Waller (Pno) with possible C. Holmes (Alto); G. Walton (Ten. Sax); A. Nicholas (Clt); H. Allen (Tpt); J. Higginbotham (Tmb); W. Johnson (Bjo); G. Foster (Bass); P. Barbarn (Dms). (Recorded 1929). EA.3713.

DUKE ELLINGTON & JIMMY BLANTON.—"Pitter Panther Patter" and "Sophisticated Lady." EA.3714.

THE ROYAL WEDDING MUSIC WESTMINSTER ABBEY & HM CHAPEL CHOIRS.—Hymn: "Praise My Soul The King of Heaven" and (b) Psalm 67: God Be Merciful Unto Us (a) Amen. EA.3715.

WESTMINSTER ABBEY & HM CHAPEL CHOIRS.—Motet: "We Wait for Thy Loving Kindness, O God" and "Palm 23: The Lord is My Shepherd." EA.3716.

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DR. O. H. PEASGOOD (Organ Solo)—Wedding March "Midsummer Night's Dream" and DR. WILLIAM MCKIE (Organ Solo)—Bridal March and Finale. EB.548.
FREDDY MARTIN & HIS ORCHESTRA.—"The Dickey-Bird Song" and "If Winter Comes." EA.3718.

JOE LOSS & HIS ORCHESTRA.—"Ay, Ay, Ay" and "Maria, Mari." EA.3719.

DENNIS DAY.—"Christmas Dreaming" (A Little Early This Year) and PERRY COMO WITH ORCHESTRA — "White Christmas." EA.3720.

ERNA BERGER.—"I Seraglio—Matern Aller Arten." ED.1192.

ERNA BERGER.—"Mass In C Minor." K.427. Et Incarnatus Est (Pts. 1 & 2). ED.800.

ERNA BERGER.—"Idomeno" Recit. Tiefs. Stille Um Mich and "Idomeno" Aria: Fruhlingsdufte. ED.801.

JOE LOSS & HIS ORCHESTRA.—"The Flower Seller" and "Misirlou." EA.3712.

THE THREE SUNS.—"On The Avenue" and "Beatrice." EA.3722.

ARTIE SHAW & HIS ORCHESTRA.—"Just Kiddin' Around" and "To a Broadway Rose." EA.3723.

PARLOPHONE

THE ORGAN, THE DANCE BAND & ME.—"South America, Take It Away" and "I'm Happy For Your Sake" (So Sorry For Mine). A.7671.

JOE DANIELS & HIS HOTSHOTS.—"Way Down Yonder In New Orleans" and "In A Little Spanish Town." A.7672.

LEO WHITE & HIS ORCHESTRA.—"The People in the Park" and "Hush-a-Bye My Pretty One." A.7673.

LEO WHITE & HIS ORCHESTRA.—"There's a New Kinda Moon" and "There's Always Another Dawn." A.7674.

LEO WHITE AT THE PIANO.—"I'm Cutting Up The Rainbow" and "Holiday in Heaven." A.7675.

THE GERALDO SWING ORCHESTRA.—"In Charlie's Footsteps" and "Two Moods." A.7676.

ROBERTO INGLES & HIS BAND.—"And Mimì" and "The Mocking Bird." A.7677.

DECCA

JIMMY MCPARTLAND & HIS ORCH.—"Sugar" and "Jazz Me Blues." Y.6096.

DORREN HENRY WITH ORCHESTRA.—"You Came Along" and "Sugar." X.2264.

MOUND CITY BLUE BLOWERS.—"High Society" and "Muskrat Ramble." Y.6096.

EDMUNDO ROS & HIS RHUMBA BAND.—"It Was Never Like This" and "Quimbamba." Y.6097.

BING CROSBY WITH THE KEN DARBY SINGERS & JOHN SCOTT TROTTER & HIS ORCH.—"The Christmas Song" and "Kentucky Babe." Y.6098.

BING CROSBY & THE ANDREW SISTERS WITH ORCH.—"You Don't Have to Know The Language" and "Apalichicola, Fla." Y.6099.

BING CROSBY WITH ORCHESTRA.—"Experience" and "But Beautiful." Y.6100.

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ANNE SHELTON WITH ORCHESTRA.—"Let's Keep It That Way" and "Good Night." G.40335.

JIMMY LEACH & HIS NEW ORGANO-LIANS.—"Down In Dreamy Valley" and "Sleepy San Benito." G.25235.

STEVE CONWAY WITH ORCHESTRA.—"Till Make 'Up For Everything" and "My Lovely World And You." G.25236.

BUDDY WILLIAMS WITH GUITAR.—"The Stockman and The Outlaw" and "My Sunny Southern Home." G.25237.

PRIMO SCALA & HIS ACCORDION BAND.—"In the Heart of Montmartre" and "The Mission of the Rose." G.40336.

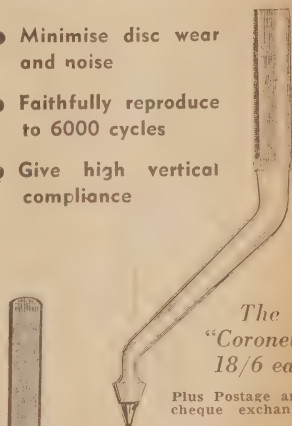
GENE AUTRY.—"Have I Told You Lately That I Love You" and "You Laughed and I Cried." G.25238.

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P.D.M. (Veitoh, Sth. Aust.) inquires as to when his next subscription will fall due. Also asks how one obtains an amateur transmitting licence.

A. Your inquiry regarding your subscription has been handed on to the appropriate department. An experimental station licence is issued by the PMG's Department upon the applicant satisfactorily passing the appropriate examination on radio and electrical theory, a Morse code test in sending and receiving, knowledge of the applicable "Q" signals and the PMG regulations pertaining to the operation of an experimental station. Previous examination papers are available on application from the Wireless Branch of the PMG's Department. A suitable textbook to study in the preparation for the examination is the The Radio Amateur's Handbook, published by the ARRL. This book is usually available at most leading book-stalls. The representative body of the Australian amateurs, the Wireless Institute of Australia, is running classes for individuals who are preparing for this examination and we suggest that you contact Mr. E. A. Barbier, Box 1234K, GPO, Adelaide, on this matter.

B.I.W. (Musman, NSW) says he has completed one Little Jim "T" receiver and built up for it an a-c power supply. He now wants to add another valve and amplifier.

A. From what we can make of your power supply circuit it would give an output voltage well in excess of the 135 volts you have marked and, in fact, it would be nearer to 300 volts. This would make things rather difficult for the 6SN7-GT and necessitate the use of well-insulated sockets to avoid risk of shock. Of course, you may have the B-plus taken off the voltage divider and this would be in order, provided the tapping point is bypassed to earth with an 8 mfd. condenser. It would be possible to add another valve, either a 6J7-G triode if you want to use headphones or a 6V6-GT for loudspeaker work.

However, we are not sure what you mean by the term "model FT" series. We cannot undertake to give postal replies to queries of this nature unless the requisite shilling is enclosed.

L.A. (Enmore, NSW) is interested in tape fidelity reproduction from recordings.

A. We do not think that the mismatch of your speaker transformer would introduce any appreciable distortion. A speaker with an impedance of 15 ohms for the voice coil impedance only holds good at 400 cycles/sec. and it is likely to be a good deal higher at higher frequencies. At the expense of wasting some power in it, you could put a dropping resistor of 2.5 ohms in series with the voice coil to provide the exact nominal load impedance, but we scarcely think this warranted. Many thanks for the information on your preamplifier and tone control system. Hum is a major problem with

a pickup such as the Lexington, which requires very high amplification at the lower frequencies. We found it desirable to mount the preamplifier on an entirely separate chassis rather than undertake the elaborate precautions that would be necessary if it were built on the same chassis as the amplifier itself. Your advertisement has been attended to.

E.H.J. (Waratah, NSW) asks for information on the construction of some form of a battery charger.

A. Yes, E.H.J., we have available on application a complete reprint of "Build Your Own Windcharger." This unit was designed especially for the charging of batteries used in general house lighting plants and obviously would cope with car batteries. The generators generally used are those from junked automobiles and a four to one ratio chain drive is arranged. The reprint pamphlet is available for the charge of 1/-.

THE following reprints are available on application at our office, 60-70 Elizabeth-street, Sydney. They will be sent, post free, on receipt of stamps or postal notes.

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4 Pages	1/-
A Pendulum Type Electric Clock.	
8 Pages	1/-
Build Your Own Windcharger.	
8 Pages	1/-
Coil Details for Small Receivers.	
1 Page	6d.
Radio Circuit Symbols.	
1 Page	6d.
Collecting Verification Cards.	
1 Page	6d.

S.H.L. (Karoonda, Sth. Aust.) forwards his subscription for R & H and asks if we have available in our files a good circuit of a portable radio.

A. Thanks, S.H.L., for your remittance. The subscription department have no doubt communicated with you direct. We have a number of portable radio circuits available, including those for personal portables. The data usually consists of a circuit diagram, a wiring diagram or underchassis photograph and a parts list. A charge of 6d is made for each item with a minimum charge of 1/-. When writing for circuits, it is advisable to state your requirements as clearly as possible.

J.S. (Punchbowl, NSW) writes in with a few words of appreciation for R & H and, at the same time, encloses for comment the circuit of an oscillator.

A. Many thanks, J.S., for your kind words and we are very pleased that you have found R & H so useful. Your

oscillator circuit makes no provision for a grid condenser, an HT bypass and filament chokes and bypass condensers.

Furthermore, the non-standard filament voltage and heavy filament current of the V190 is, in any case, a serious disadvantage. Good, clean keying without "chirps" is difficult to obtain with a self-excited oscillator. The use of a modulated oscillator is not recommended for any band, not even for 14mc where the possibility of the band becoming crowded is not at all remote. Because of the inevitable frequency modulation, the modulated oscillator occupies a greater channel than that necessary for satisfactory communication. As to the electrical principles of your circuits, the use of tuned concentric lines does not become important until the frequency of operation goes well beyond the 14mc band, namely, up to and around 300 mc. On the 14mc band, the use of parallel line tuned circuits is simpler.

K.R.L. (Toowong, Qld.) says that a pigeon club has been formed in his town and he is very anxious to see a pigeon section started in "Radio & Hobbies" to cater for readers interested in this hobby.

A. Thanks for your letter and for the suggestion but there is no chance of our including such a section as we are already very much up against it in regard to space allocation. However, we include your full name and address to give other readers opportunity to correspond with your club, if they are in a position to offer assistance (Mr. K. R. Lewis, 174 Crescent-road, Toowong, Brisbane).

C.B.H. (Campbell, Q.) has had excellent results from the "Pentagrid Filter" except that a faint whistle is evident with the volume control in a certain critical position.

A. The trouble in your set is apparently some sort of audio instability and we suggest you make quite sure that the lead of the 1K7G is shielded over its full length, and likewise the lead to the "hot" side of the volume control. Keep the plate wiring of the output valve well away from input circuits, and try a 100 mfd condenser from the output plate lead to earth or B plus. It is just possible that the volume control itself may be faulty, allowing an unusually high impedance between the wiper and the 1K7G and earth. A 5 meg. grid resistor in place of the 10 meg. resistor may also be of some assistance. We are glad to note that you find Radio & Hobbies so interesting and in particular the article on the movie projector.

D.G.H. (St. Lawrence, Qld) accompanies his subscription renewal with words of praise for the performance of the R & H "Springtime Portable".

A. Your remittance, D.G.H., has been dealt with by the subscription department. We are very pleased to note your satisfaction with the results of your "Springtime Portable" and thank you for the congratulations.

A.L. (Semaphore, Sth Aust.) forwards a remittance in connection with subs.

A. The subscription department has handled your remittance. A.L. Pleased to know that your D/W set is "going strong" and that you have started your quest for verification cards. Good luck.

K.B. (Port Melbourne, Vic.) asks for dimensions of the chassis used in the 2J1 series of transmitters and modulators, &c.

A. The dimensions are 17 inches long by approximately 8 1/2 inches wide, and 3 inches deep. The grounded-plate amplifier is, in effect, a cathode-follower. You will find details of this amplifier on page 71 of the latest ARRL Handbook.

F.A.W. (Sth. Yarra, Vic.) tells us about the success which he has had with the five-valve "Handle-Talkie even with daylight reception. He also expresses his satisfaction with the magazine.

A. We are pleased to note, F.A.W., that you are one of the well-satisfied constructors of the "Handle-Talkie." We thank you for your words of appreciation concerning the magazine. In connection with your subscription, it will continue at the old rate until expiration at which time the renewal will be at the new rate.

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1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes and cut-outs will be supplied if available for 2/6. Endorse envelope "Blueprint."

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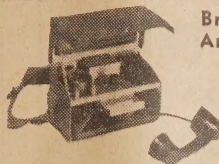
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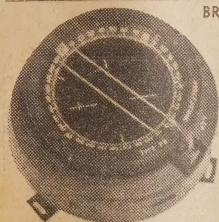
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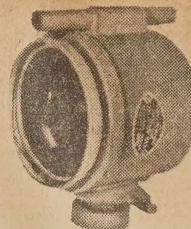
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Perspex can be bent by immersion in hot water.

C.B.W. (Tarana, NSW) requests a copy of the pamphlet "Build Your Own Wind-charger."

A. You have received the copy some time ago. C.B.W. We are pleased to know that you find the articles in R & H very interesting. The reception of WCKY, Cincinnati on 1530kc. speaks well for the sensitivity of your receiver.

"stumped" (Rockhampton, Qld.) submits an Ohms Law query for clarification.

A. There is really no trick in the question. It merely requires the application of Ohms Law and the bearing in mind of Kirchhoff's Law. Your solution is quite correct, but you strayed a little on the question of the division of current through resistive branches. In this case, the current through the resistor marked "X"

would be 5 mA. In other words, 10 mA passes through that portion of the circuit comprising the two 1000 ohm resistors in parallel. Because these resistors are of the same value, the 10 mA of current divides evenly through each branch, hence the 5 mA through the resistor marked "X". When a certain current flows through parallel networks, it divides through each branch inversely as the values of the parallel resistances. Had the branches been of 500 ohms and 1000 ohms, the current through the 500 ohm branch would be two-thirds of the total current and that through the 1000 ohm branch would have been one-third of the total current. The question of the lower the resistance the higher the current applies to the TOTAL resistance in the circuit and not the value of each in-

dividual resistance in the series network. When this is observed, the voltage drop across each resistance will then be governed by the value of that resistance. Suitable treatment of this type of problem can be made if consideration is given to the basic factors governing resistances connected in series and parallel. The filament circuit of your battery set may be arranged to operate from 6 volts by connecting the positive side of the 6 volt battery through the 1L5G then through the filaments of the 1C7G and the 1K7G connected in parallel and then through the 1D5G to earth. Across the filament of the 1D5G connect an 11 ohm resistor. In some cases, the bias can be taken from a certain point in the filament network. Back-biasing is not practicable without a considerable amount of juggling when the filaments are connected in series or in series-parallel.

R.L.H. (Christchurch, NZ) speaks of his interest in the articles published in the R & H magazine and offers a suggestion as to material suitable for inclusion.

A. Thanks, R.L.H., for your letter and we are pleased to have your interest in the magazine. We are not in a position at the moment to consider special inserts in the magazine. However, a one-page chart of circuit symbols was published in July 1942 issue of R & H. A reprint of this page is available through the 1/- query service.

K.T. (E. Malvern, Vic.) tells of his success with the T.N.T. in the February issue and also the 807 amplifier featured in the April, 1947, issue.

A. Interest in the particular amplifier has been overshadowed recently by talk of triodes with feedback but the difference has a rather academic flavor. Like others of its type your 807 job is really good and we are not surprised that it has made such an impression on yourself and others who have heard it. Many thanks for your kind remarks in regard to Radio and Hobbies.

J.L. (Kalpowar, Qld.) writes in appreciation of Radio & Hobbies, particularly the "Service Work" section. Also requests reprints of "Build Your Own Wind-charger" and "Coil Data for Small Receivers."

A. Many thanks for your letter. Your pamphlets were forwarded direct. We note your request concerning articles on battery and vibrator powered sets and cures for vibrator troubles, and agree that such are of interest. While not making any promises, we can say that such items are contained in the list compiled for future publication.

H.W.E. (Mundijong, WA) writes in appreciation of R & H, and is one of many readers who expresses the opinion that it is well worth a shilling.

A. Thanks a lot for your expression of interest in the magazine and for your comments regarding the increased price. Many other readers have testified to the amount of useful information they have received from our columns.

R.A.L. (Five Dock, NSW) sends in for comment the circuit of a crystal set, which is reputed to work a loudspeaker.

A. A crystal detector, no matter how good or expensive, cannot amplify, so that the reproducing device has to work on the small amount of energy received by the aerial. All we can suggest is that the designer of the set in question suffered from a very vivid imagination or that he lived very close to a broadcast station.

G.J.W. (c/o GPO, Fremantle, WA) speaks well, in a letter, of the performance of the "1947 Senior Radiogram" and the "Little General." Also suggests a subject for treatment in a future article.

A. Thanks G.J.W. for your interesting letter and comments concerning the performance of these particular sets and also the "Vox Minor" amplifier. We note your suggestion for an article on P.E. sets and the uses and have filed this for future reference. Current magazine production costs entirely justified the recent increase in price.

M.J.B. (Kingsgrove, NSW) wants to know where he can purchase the power transformer specified for the "Little General" circuit of the August, 1947, issue of R & H.

A. Your difficulty in obtaining a suitable power transformer, M.J.B., is unusual as transformers of this size are readily available in most of the radio supply houses in the city. We suggest that you telephone, write to or call at any of the leading radio houses and we feel reasonably sure that you will not be disappointed.



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ANSWERS TO CORRESPONDENTS

P.S.L. (Croydon, Vic.) suggests, that many readers would be interested in a midge AC/DC receiver.

A.: We agree that there is a certain call for such a set, but we do not favor the principle for home construction, owing to the risk of shock. The same remarks apply to receivers for the d-c power mains.

R.J. (St. Caulfield, Vic.) writes to tell us of his experience with an intermittent set. He would like our advice about using a 16 mfd. in his set instead of the original 8 mfd. unit.

A.: The 6F6-G probably has an intermittent internal connection which depends on the temperature of the valve—most likely to the cathode. Since you say that your set is very quiet, there would be no advantage in having the larger capacitance filter. Its only effect would be to reduce the hum level which is already so low as not to be noticed. Your kind remarks are very much appreciated.

C.W.C. (Concord, NSW) forwards a remittance for subscription and tells of the success which he has had with the "Two Valve Regenerative Set" which was described in the Short-Wave Handbook.

A.: Thanks, C.W.C. The subscription department has dealt with your remittance. It is pleasing to read of your success with that little set, particularly when using a speaker. Your aerial arrangement resolves into two aerials being fed to the set simultaneously with independent coupling. As aerial coupling affects signal-to-noise ratio, it would appear that the coupling provided for the aerial connected to the tap favors this ratio more than the aerial wire connecting to the primary winding. To obtain greater coverage on the broadcast band it will be necessary to provide for greater variation of capacitance or of inductance. This means an increased value on tuning condenser or the use of a tapped coil. Alternatively, two coils could be used.

B.M. (Maryborough, Qld.) encloses a remittance for subscription and offers his ideas on the type of subjects he would like to see covered in R. and H.

A.: The subscription department has suitably dealt with your enclosed cheque. B.M. Your ideas on subjects for inclusion in the magazine are noted and we appreciate your interest. A number of the subjects are already coming into line for inclusion in future issues.

I.N. (Yea, Vic.) forwards an additional remittance for subscription, plus some very kind words concerning the standard of the magazine.

A.: The subscription department has dealt with both your remittance and your change of address, I.N. Thanks for your good wishes and expression of appreciation for the contents of R. and H. We trust that you will continue to find that it measures up to your requirements.

W.W. (Flemington, Vic.) forwards the description of some ideas which he has found to be of use.

A.: Thanks, W.W. for your letter. We have filed your letter among the data for the "Reader Built It" section for possible use at a later date.

W.J.P. (Wagga Wagga, NSW) wishes to know if it is in order to use a 7000 ohm output transformer with a 6V6-G, instead of the usual 5000 ohms.

A.: Yes. Theoretically, there would be a slight increase in the third harmonic distortion while the second harmonic distortion would be decreased by a small amount. However, the effect is very small and would probably not be noticed in practice.

Thanks for the kind remarks and it is pleasing to note that you have had such good results with "Tex."

R.J.N. (Cessnock, NSW) forwards a subscription and inquires as to whether or not it is necessary to have a licence to advertise as a Radio Serviceman.

A.: To the best of our knowledge no such licence is required and, provided you feel confident to undertake the work, you are free to do so without restriction. Many thanks for the subscription and the kind remarks.

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FOR SALE: 5v "Springtime Portable," almost new, £20, or best offer. B. O'Keefe, Winslow, via Warrambool, Vic.

FOR SALE: Vox Minor, 5W. amp. elec. table, pick-up, 12in. spkr., 10in. spkr., 1 G.E. millimeter 0-250, 1 G.E. R.F. amplifier 0-4, 1 pr. Rola mov. coil, and 1 pr. Ericsson phones. G. J. Wood, 5 Bruce-street, Toorak, S.E.2, Victoria.

FOR SALE: Valves 68, 2A6, 2A7, 2A5, 80, 2 1 trans., 385v. 2v. fil. winding, 2 TRF coils and other radio parts, extra good condition, £4 the lot. Call Saturday between 2 p.m. and 4 p.m. 16A Fairview-street, Concord.

FOR SALE: New AT5/AR8 generator power supply, complete with all filters, two generators, each 26-volt input, 550-volt, 350 ma and 250-volt 100 ma output, circuit available. £15 or offer. F.O.R. J. Watt, P.O. Box 60, Bourke.

FOR SALE: Radio & Hobbies, Apl., "44, to June, '46, Ellipsoidal Mike (new), S/H M.G.M. Super Tone Chromatic Mouth-organ, Mossberg Single Shot Rifle, Write Canson, P.O. Box 29, Rockdale, N.S.W.

FOR SALE: 2-valve Battery Radio, plug-in coils, cabinet, Rola speaker. Best offer, with exchange for Capitol Plunger fishing reel. D. Waterhouse, Box 12 P.O., Woolgoolga.

FOR SALE or Exchange: Palec VCT and VCT-V, Bendix 221 freq. meter with calibration book; new Philscope, 1 hp. Rep. St. \$400 motor. Wanted AVQ model 7. All good. Best offers. McLennan, 20 Ferry-street, Edwardston, Adelaide.

FOR SALE: Three "Healing Flared Horns" for P.A. work, perfect order (used twice), 35/- each or £5 lot, originally cost 50/-, plus tax. E. C. Jamieson, Forresteron, S.A.

FOR SALE: One-valve set, cheap, excellent reception, complete new 2000 ohms phones, attractive polished cabinet. K. Norrie, Forbes-st., Carrington, Newcastle.

FOR SALE: New 3-valve personal portable, complete batteries, speaker, valves, polished cabinet, cheap. A. Acheson, 23 Hickson-street, Wickham, Newcastle.

FOR SALE: 2-valve Battery Set, plug-in coils, with 1 new "B" Battery. Less phones. Just completed, £5. D. Chesterfield, Mirboo Ndl., Victoria.

FOR SALE: R. & H. Vol. 1, No. 1, 3, 6, 8, 10, 11, 12. Vols. 2-9 complete, 103 copies. Also quantity radio parts and B eliminator, WM3633 Saturday morning.

FOR SALE: 1946 "Penguin Four," complete with valves, speaker and dial. Less cabinet and batteries, £14/10/- Write F. Heffernan, Buckajo, Bega, N.S.W.

FOR SALE: 2" A.W.A. Portable Cathode Ray Oscillograph, complete, as new. Apply W. Baxter, Morisset, N.S.W.

FOR SALE: R. & H. Minivox, perfect working order, less cabinet, £10. Nell Learmonth, Blundell-parade, Corralra.

FOR SALE: (1) new, Type B13 transmitting tube, £5, or best offer. F. S. McCarthy, 42 Britannia-street, Geelong West.

FOR SALE: Japanese communication receiver, 9 valves, £20. W. H. White, Murray Valley Highway, Cobram, Vic.

FOR SALE: Garrard Model S Unit Pick-up automatic stop, £5. AWA 3-gang 10/- FD32 Dial, 12/6. Aer. osc. RF coils, B/C Aircore, 7/6. Nixon, Ridgewell-street, Lakemba, N.S.W.

FOR SALE: Palec valve tester, model V.C.T. New condition, £19. Nunes, 501 Dowling-street, Moore Park, Sydney.

FOR SALE: Circuit of MCRI Disposals, Receiver, 2/-, post free. K. Evans, 17 Cambridge-street, E.3, Victoria.

FOR SALE: "Tex" less phones, excellent condition, £81. J. Greenland, Rob Roy, via Inverell, N.S.W.

FOR SALE: 5v. Portable, complete valves and batteries, as new, £18 or best offer. K. McCartney, Echuca, Victoria.

FOR SALE: One Bendix T A 12 D transmitter, less valves, includes meter; new. Price £9/10/- Write R. Newsome, 13 Sheriff-st., Hermit Park, Townsville, Qld.

FOR SALE: One 3-valve "Minivox" Mantel, good performer, £9/10/- P. Alexander, 24 Rockley-road, Sth. Yarra, Victoria.

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FOR SALE: Palec VCT-V, good condition, £13. Quantity new tubes, 8-42 PM Speaker, 40 copies R & H 101 Tonkin-st., Cronulla, NSW.

FOR SALE: 1000 kc Frequency Standard Crystal ex-Bendix Crystal Wavemeter, Hermetically sealed on octal base. What offers? Hyde, c/o Post Office, Hydro, Qld.

FOR SALE: Type A Mk. III transceiver, 6v. DC or 100 to 250v. AC, complete with spares and instruction book, new, £8/10/- Ham band receiver, new, 2 J.V.5 circuit with EF50 RF stage. Complete with valves and coils, but minus power supply and speaker, £12/10/- W. R. Jardine, Box 52, Leongatha, Victoria.

Readers wishing to buy, sell or exchange goods are invited to insert an advertisement on this page. The cost is 1/3 per line; minimum charge 3/9. Approximately 5 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, NOON AUG. 11, 1948. Dealers' advertisements not accepted.

FOR SALE: University multimeter, complete, £9, also following new parts, Kingsley I.F. 5/- 12/-, 3in. per inch, 1000 ohm, 5/6; mid. LF 10/-, Rola mid. H.T. chokes, 60 ma., 10/- mid. 2-gang tuning condenser, 15/-, P. Allen, Wordsworth-street, Bulimba, Brisbane.

FOR SALE: Heavy duty Inverter, 32 volts D.C. to 1500v. 200 ma. D.C. Brand new Admiralty job, suit country transmitter. Offers to E. Pass, Holland-street, Greenslopes, Brisbane.

FOR SALE: 2-valve radio, less batteries and speaker, good order, £5, posted; 2 new 1K5-6 valves, 12/- each; R.C.S. E345 and T17 coils, 3/- each. M. Rohtack, Canberra, S.A.

FOR SALE: 81 copies R. & H. from July, 41, to April '48, new condition; also few Radio Worlds £31. L. Ballard, Box 5788, G.P.O., Adelaide.

FOR SALE: Box of radio parts: conds., resistors, chassis transformer, coils etc. Bargain £2. K. Donges, Montague, N.S.W.

FOR SALE: Little Jim II, 6.3v. filament, smart leatherette cabinet, £5. D. Langford, 58 Brett-street, Georgetown, Newcastle.

FOR SALE: 4 2" spkrs., 23 pl. con., 25/- or exch. for road 3, 5 or 6" per mag. spkr. I. Mackinnon, P.B., Casterton, Vic.

FOR SALE: Double spring gramophone motor and pick-up, best offer. E. Davis, 78 Denison-road, Lewisham.

WANTED: Has anyone a Kodak Duo Camera (split 120 size) they don't use any more? Am anxious to secure same, so if you can help me, please contact J. Hodgkinson, Nambucca Heads.

WANTED: To Buy or Hire: No. 7 and 8 or complete set of Master Mind system, or information as to present headquarters, Mrs. T. Small, 168 Smith-street, Summer Hill.

WANTED: Any spare books which you would care to donate to a young people's library — Nature, Biography, Travel, Science, Hobbies, Arts, Crafts, S. P. Geddes, Tumbl Umbi, via Wyong, NSW.

WANTED: 32 or 50 volt rotary converter to 240 volts AC. Slate output. C. W. Ziebell, Mt. Tyson, via Oakley, Queensland.

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WANTED: Following issues of R. & H. Xmas '39, also Vol. 9, Nos. 1, 2, 3, 4, 8 and 9. D. Bryan, 24 Walbundry-avenue, North Balwyn, Melbourne.

WANTED: Copy, data and circuits for "Hickok Valve Checker, Model 48. R. Fitzsimmons, Frederick-st., Morsham, Vic.

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